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ANNALS of SURGERY

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PNEUMOVENTRICLE OF THE CEREBRUM FOLLOWING FRACTURE OF THE SKULL*

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PNEUMOVENTRICLE of the cerebrum of traumatic origin is a rare condition, which justifies the report of the following case:

H. P. (Kansas City General Hospital No. 2353, 1922.) Age sixty. Huckster. Entered the hospital September 10, 1922, in a drunken, semiconscious and delirious state, having been found on the sidewalk by the police. There were no bruises or lacerations about the head or face. There was a profuse discharge of blood-tinged cerebrospinal fluid from the right ear. Frequent vomiting. The patient had no recollection of being injured. It was assumed that in his drunken state he had fallen and struck his head on the sidewalk.

Previous History.—Drank alcohol in large quantities. Fracture of the skull in 1921, (Kansas City General Hospital No. 120, 1921). Radiograms of the skull show a fracture identical in location with the present fracture. There was hemorrhage from the nose and right ear.

Physical Examination.—Patient well developed and nourished, age 60. Marked alcoholic intoxication. Blood-pressure, systolic 110, diastolic 80. Pulse 68, regular and full volume. Respiration 20, deep and regular. Temperature, 97.8.

No lacerations or contusions on the head or face.

Eyes. Right pupil dilated, left contracted. Both reacted to light. Ocular fundi normal. Ocular movements normal.

Ears. Copious discharge of blood-tinged cerebrospinal fluid from the right ear for about twelve hours. Small perforation of the right tympanic membrane. Hearing diminished in both ears, more marked in the right.

Nose. Normal, no hemorrhage.

Neck. Pronounced jugular pulsation.

Thorax and abdomen normal.

Extremities normal, with the exception of scars on both legs from old varicose ulcers.

Reflexes considered normal throughout.

Cerebrospinal fluid blood-tinged. Intraspinal pressure 12 mm. of mercury. Spinal Wassermann four plus positive.

Blood Examination.—Hæmoglobin 85 per cent. Erythrocytes 3,000,000. Leukocytes 4800.

Radiograms of the skull on September 11, 12 and 13, show a linear fracture beginning in the posterior superior part of the right parietal bone, extending

* Read before the Western Surgical Association, December 9, 1922.

downward and forward through the external auditory meatus. No evidence of depression. The interesting feature in the plates is the fact that the lateral cerebral ventricles are shown distended and filled with air. The lateral views show the entire lateral ventricles distended with air and an area of slightly

FIG. 1.—Antero-posterior view showing the left lateral ventricle widely distended with air and displacing the right ventricle, which is not so widely distended, to the right. The inferior horn of the left ventricle is shown distended with air, but the right inferior horn is invisible.

diminished density in the right middle cranial fossa probably due to air. The antero-posterior view shows the left lateral ventricle widely distended and displacing the right ventricle, which is not so widely distended, to the right. The inferior horn of the left ventricle is shown distended with air, but the right inferior horn is invisible. This is probably due to the fact that the air has not become evenly distributed between the two ventricles after changing the head from the lateral to the antero-posterior position. Air is not seen in the right middle fossa in the antero-posterior view. Radiograms taken September 29, eighteen days after the injury, show practically a complete absence of air in the ventricles

Progress. The day following the injury the patient said he felt well and asked to be discharged. He said he had no headache, but he vomited occasionally.

On the third day a partial facial palsy developed, peripheral in type. There was slight increase in the tendon reflexes of the lower extremities. Babinski reflex positive, bilateral. Abdominal and cremasteric reflexes diminished. No loss of sensation. Pupils equal and reacted to light and accommodation. Slight headache, no nausea or vomiting. Slight dizziness and some mental confusion.

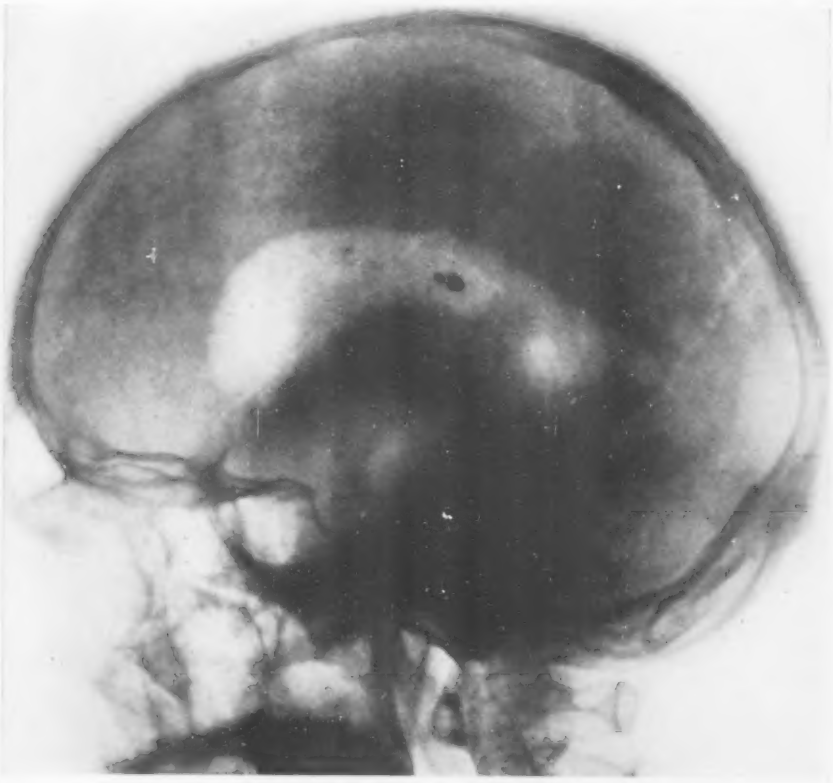

FIG. 2.—Lateral view showing the distended and air-filled lateral ventricle.

Optic discs showed no evidence of compression. The dizziness and mental confusion gradually subsided over a period of about three weeks, and the reflexes returned to normal. Spinal pressure normal, September 29. There was a gradually increasing diminution in hearing in the right ear.

He was discharged from the hospital, at his request, October 23, 1922. He was clear mentally, no dizziness and no headache. There was partial paralysis of the right seventh cranial nerve, and complete paralysis of the auditory portion of the eighth nerve.

Diagnosis. Pneumoventricle cerebri, following fracture of the right parietal and temporal bones, the fracture passing into the right auditory meatus and petrous portion of the temporal bone. Delayed paralysis of the right eighth cranial nerve, with partial paralysis of the right seventh cranial nerve.

A review of the scant literature on the subject brings out some interesting features of this condition. It has been associated with intracranial

aerocele, and the two conditions are so closely associated as to justify simultaneous consideration.

Skinner, Holmes, May, Glenard and Aimard, Barbe and Glenard, and Horrax have reported cases of intracranial aeroceles. In each of these cases the intracranial aerocele followed fracture of the frontal bone with involvement of the frontal sinus. This would lead one to assume that the air gained entrance to the intracranial spaces by way of the frontal sinus.

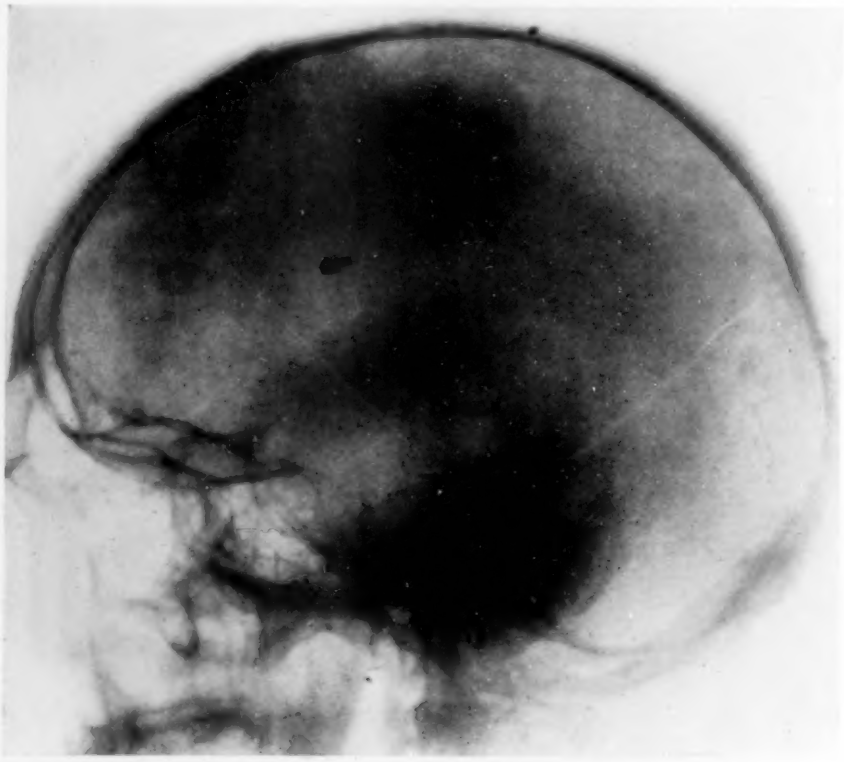

FIG. 3.—Lateral view taken eighteen days after the injury, showing that the air has been absorbed from the ventricles. The line of fracture is plainly visible. Radiograms by Dr. L. A. Marty.

LUCKETT, in 1913, claims to have reported the first case of traumatic pneumoventricle cerebri. The patient had a fracture of the frontal bone involving the right frontal sinus. Early radiograms showed no air in the ventricles, and he was discharged from the hospital. About two weeks following the injury the patient sneezed, had a severe pain in the head and a flow of about a cupful of clear fluid from his nose. Two days later he reëntered the hospital mentally confused, with headache, vomiting, optic neuritis and partial aphasia. Right subtemporal decompression showed a slight meningitis. Ventricular puncture brought forth a few spurts of air. A suboccipital opening was made to drain the cisterna magna, and on entering the cisterna magna cerebrospinal fluid containing bubbles of air escaped. The patient died three days later. Autopsy showed air in the ventricles, and also a laceration of the right frontal lobe communicating between the fracture in the right frontal sinus and the anterior horn of the

lateral ventricle. It was assumed that the sneezing forced air from the frontal sinus, through the laceration in the frontal lobe, into the anterior horn of the ventricle.

LUCKETT, in 1917, reported a second case with fracture of the frontal bone involving the orbital plate. As in the first case, no air was found in the ventricles and the case was discharged from the hospital, to return a week later with mental confusion, dizziness and headache, and signs of intracranial compression. Radiogram showed air in the cerebral ventricles. Right subtemporal decompression showed only slight signs of increased pressure, and air was demonstrated by ventricular puncture. A few days after the operation only a trace of air was found in the ventricles. No history of sneezing. The patient recovered.

POTTER, in 1919, reported a case of hydropneumocranium with air in the ventricles. The patient was injured 19 days before coming under his observation. There was no loss of consciousness. Radiograms of the skull showed a stellate, comminuted fracture of the frontal bone centring about the right supraorbital notch. Intracranially, beneath the site of fracture, was evidence of a gas accumulation in shape and size comparable to a hen's egg. The patient had headache for a week and dizziness on bending the head forward. Two weeks later there was considerable increase in the size of the gas chamber and the lower half was filled with fluid. On changing the position of the head the fluid level changed, and there was an audible splash. At this time the lateral ventricle was partially filled with air. The exact date of the absorption of the air was not known, but no air was found on the 56th day. The patient recovered. It was assumed that the air chamber became filled with fluid as the air was absorbed. Potter believes that these air chambers are a potent factor in the formation of intracranial "traumatic cysts."

HOLMES, in his report of a case of intracranial aerocele, mentions a case of Doctor Walter J. Dodd, in which there was air in the ventricles. The case was not reported.

Dandy, in his work in ventriculography, states that there are no deleterious results from injecting air into the cerebral ventricles. Headache occasionally follows, but this is readily relieved by ventricular puncture. The headache is due to an increase in intraventricular and intracranial pressure, rather than to the presence of the air, otherwise the ventricular puncture would not give relief. Dandy also says the air is slowly absorbed day by day, and is absorbed in about two weeks in cases of hydrocephalus.

It is probable that air in the cranial cavities and spaces causes symptoms only by increasing intracranial pressure. It may also act as a carrier of infection. Potter believes that air in the cranial cavity is a potent factor in the formation of traumatic intracranial cysts. In his case he observed the air being absorbed within the intracranial gas chamber and fluid replacing it. The same process was observed by Glenard and Aimard in their case, covering a period of two months. Barbe and Glenard report the autopsy findings on this patient, who died of another condition nearly a year later. They found a cyst at the site of the original air cavity containing 25 c.c. of fluid.

The period required for absorption of the air varies from a few days to more than two months. In Luckett's second case there was only a trace

of air in the ventricles in radiograms taken a few days after its appearance; however, most of the air was removed during the operation. In the case reported by Horrax, the aerocele was not discovered until it came under his observation about a month after the injury and operation. The air was absorbed sometime within the next seven weeks. From the cases reported, it seems that the air was absorbed from the ventricles more rapidly than from cavities elsewhere in the cranial cavity. In the case reported by Skinner, the air was aspirated four weeks after the injury. Chemical analysis showed it to be mostly nitrogen.

The route of entrance of air into the ventricles in Luckett's first case was proven at autopsy to be by way of a laceration in the right frontal lobe communicating between the fracture in the frontal sinus and the anterior horn of the lateral ventricle. This is apparently the only case reported of pneumoventricle to come to autopsy.

Potter suggests that the probable route of travel of the air in his case was by way of the subarachnoid space to the cisterna magna, thence by way of the foramen of Magendie, fourth ventricle, iter, third ventricle and the foramina of Munro to the lateral ventricles. This seems a roundabout way, but the finding of air bubbles in the fluid of the cisterna magna in Luckett's first case proved that air travelled such a route as far as the cisterna magna.

The author wishes to offer a probable route more applicable to his case, which is the only reported case in which the fracture was through the external auditory meatus and the petrous portion of the temporal bone. As the cerobrospinal fluid escaped from the right ear it is assumed that the air gained entrance by the same route. Fractures in this region tend to cross the floor of the middle cranial fossa to the floor of the sella tursica. The floor of the third ventricle lies in this region. The floor of the third ventricle in the post-chiasmal region and about the tuber cinereum is very thin, and the infundibular process of the third ventricle passes well into the pituitary stalk. A fracture in this region, with a sudden displacement of the brain placing these tissues under tension, might easily lacerate into the third ventricle, and permit an egress of ventricular fluid and an ingress of air. The air would then readily pass through the foramina of Munro into the lateral ventricles. This route has not been established, but is offered as a plausible and probable route.

Air was forced into the ventricles in Luckett's first case during an attack of sneezing. Compression of the air may have been a factor in the case of intracranial aerocele reported by Skinner, his patient being injured in an explosion. The author's case was in a wild delirium during the first night and had to be restrained. In resisting restraint air may have been forced through the eustachian tube and middle ear into the middle fossa.

Of the four cases of pneumoventricle reported in the available literature there was one death. This death was from meningitis. The result was not stated in the case of Doctor Dodd. There were four deaths in the six cases

of intracranial aerocele. Three were from meningitis, and one as a direct result of the injury.

As the presence of air in the cranial cavity or ventricle does not in itself cause any deleterious effects, the treatment should be directed against its most common complications:

1. Meningitis.
2. Intracranial compression.
3. Its tendency in intracranial aerocele to the formation of cysts by replacement of the absorbed air with fluid.

Aseptic and antiseptic treatment of the wound of entrance of the air is of prime importance. Air in the ventricles is rapidly absorbed, and in the absence of other indication for operative measures, notably increase of intracranial pressure, may be ignored. In the cases of intracranial aerocele the air seems to be absorbed more slowly, and on account of its tendency toward cyst formation, should be aspirated or drained. Drainage would also tend to lessen the danger of meningitis. The drainage or aspiration, if done, should be done early. The accompanying skull fracture and brain injury will usually indicate the type of treatment to be employed.

Pneumoventricle cerebri, and especially intracranial aerocele, probably occur more frequently than the literature indicates.

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POST-OPERATIVE INFECTIVE PAROTIDITIS*

By William H. Fisher, M.D.

of Toledo, Ohio

It is the intent of this paper to deal with the various grades and types of infection that occur in the parotid following operations upon distant parts of body.

In order to present a clearer picture of the various phenomena that obtain in the infective inflammations, the following classification is adopted. This classification is based upon the clinical manifestations that occur, representing, as they do, varying degrees of severity in the infective processes and the resultant systemic reaction.

Classification.—(1) Acute parotitis, or simple inflammation. (2) Acute suppurative parotitis. *a* Circumscribed parotitis or lobular parotitis. *b* Diffuse parotitis. (3) Gangrenous parotitis.

Post-operative inflammation of the parotid is infective in character. Though the case may be a clean operation, foci of infection exist somewhere in the body and bacteriæmia exists in a greater or lesser degree. The resistance of the patient, the susceptibility of the gland, the potency of the infective agent, will determine one or the other of the types that will develop.

(1) Acute parotitis or simple inflammation of the glands follows operation from three to five days. It is represented by malaise slight elevation of temperature and pulse rate, stiffness of side of face, swelling of gland anterior to ear, with pain on pressure. Under proper treatment this inflammation subsides in three or four days without any untoward effects. It is exceedingly common and seems to have been more prevalent in the late epidemic of contagious and infectious diseases.

> *Illustrative Case.*—Anthony D., age twenty-eight, suffering with an acute gangrenous retrocæcal appendicitis, duration one week, was admitted to St. Vincent's Hospital and operated January 17, 1923. The third day he developed a left-sided parotitis.
>
> This patient already in a serious state reacted slightly to the parotid involvement. This systemic reaction was represented by an increased temperature rate and more rapid pulse. Locally, there was decided discomfort, with pain, swelling of gland and dryness of mouth. With the application of iodine and ice the enlargement rapidly subsided and had entirely disappeared on the fifth day.

Second type or acute suppurative parotitis. *a* In the first division, classed as circumscribed or lobular parotitis, where abscess formation has taken place, both local and systematic reaction are intensified in comparison with type one. It is next in frequency but relatively rare. The infective process attacks the lobules spreading to the periphery and infiltrates the glandular structure. With

* Read before the Toledo and Lucas County Academy of Medicine, June 1, 1923.

this inflammatory infiltration Stenson's duct remains patent and, when no obstruction exists, pus readily extrudes itself into the oral cavity. Gentle pressure on parotid, associated with bimanual manipulation, practiced often leads to ultimate recovery.

It is necessary in this type to exclude any occlusion of the duct by stone or cicatrices in the buccal mucous membrane. There may be present an inflammatory occlusion of the duct which is relieved temporarily by the passage of a probe, and the procedure should be continued till the obstruction is eliminated. In one case the writer split the orifice of the duct one-quarter inch and removed an impacted stone, which was followed by a free flow of pus. The case recovered without further surgical intervention.

Illustrative Case.—Mrs. M. H., age fifty-five, suffering with duodenal ulcer; infective cholecystitis and lymphangeitis with many perigastric and perihepatic adhesions, was operated upon at St. Vincent's Hospital, December 20, 1915. Cholecystectomy and posterior gastro-enterostomy with pyloric exclusion were performed.

Third day developed a right-sided parotitis represented by chill, elevation of temperature and pulse rate, general myalgia. Locally, pain and swelling not diffuse but somewhat circumscribed and involved the anterior and superior portions. With the application of iodine and ice the patient improved but it was noted accidentally that pressure on parotid expressed pus from Stenson's duct. To relieve the pain of distention the patient became adept in the manipulation of the gland. Without further surgical intervention this case entirely recovered.

b In the second division of suppurative parotitis classed as diffuse parotitis there is surgical pathology of grave import.

This type is rare. But few cases or none are allotted in the life work of the surgeon as an individual. Collectively there have been many reported cases. Its inception is ushered in with local and constitutional symptoms as in the other types. Differentiation may be determined as the hours elapse as to its probable severity, by the augmentation of both objective and subjective signs. At no stage of the inflammation is there a diminution in the severity of symptoms; suppuration occurs early, from thirty-six to forty-eight hours; immense swelling of face; dysphagia; meningeal disturbances and nerve irritation associated with repeated chills, rigors, and high temperature and rapid pulse; leucocytosis increased.

If spontaneous evolution does not take place early, *i.e.*, the evacuation of pus through Stenson's duct, the parotideo-masseteric fascia covering the gland becomes involved in the necrotic process and pus infiltrates the surrounding teguments, burrows through the external auriculation, may fuse towards the supraclavicular region, or, following the sheaths of the vessels, involve the mediastinum. Retropharyngeal abscesses have been noted. The mortality rate in this type is about 30 per cent. In cachectic cases this type has a determination towards a gangrenous evolution. The violet skin becomes sphacelous, allowing multiple gas bullæ to escape, as well as sanious fluid of infected odor.

Illustrative Cases.—(1) Mrs. H. M., age forty, suffering with infected laceration of cervix, retroversion, visceroptosis, and chromic appendicitis, was operated upon at St. Vincent's Hospital, January 19, 1923. Operation consisted of high amputation of cervix, appendectomy and shortening round ligaments (Baldy's technic).

On third day complained of pain in left ear and side of neck. On fourth day complained of pain in left cheek. On fifth day tumefaction of parotid was noticed; this rapidly increased in size with repeated chills, temperature 103, pulse 100: much phlegm in mouth with dysphagia, beginning disturbance of seventh nerve. Complete suppuration of entire gland had taken place and the surrounding tissues were infiltrated with pus.

The exposure of gland was obtained by a long incision from the zygoma, anterior and close to the tragus, down along the sternocleidomastoid muscle, and further supplemented by a two and one-half inch curvilinear incision extending from the mastoid and joining the original incision. This latter clearly exposed the retromandibular fossa. Immediate improvement was noted.

Culture showed the staphylococcus present.

Discharged from hospital on thirty-third day, healing of parotid incision having taken place. Recovery of muscles noted; slight drooping of corner of mouth and eyelid; no salivary fistula, but some discharge from external ear. Later examination shows entire recovery of nerve, no depression of side of face, scars dimly visible.

This parotidean incision healed readily and with minimum scar. The writer urges its employment where the suppuration has extended into the surrounding tissues and especially to reach the retromandibular fossa. The parotidean incision would simulate the letter Y.

(2) Miss E. R., age forty-five, was operated upon March 13, 1920, at St. Vincent's Hospital for adenocarcinoma of stomach. A Polya operation was done, resection of four-fifths of stomach and enucleation of all involved lymphatic glands. Post-operative parotitis developed on the twelfth day associated with grave systemic disturbances. On the fourth day of its inception, March 29, 1920, the Blair-Lilienthal incision was made, exposing the suppurating gland in its entirety; multiple transverse incisions made; much debris removed; cavity packed with iodoform gauze and incision left open. Examination of pus showed pure culture of staphylococcus.

Healing was rapid; temperature and pulse range approached the normal; no nerve disturbance; depression existed in parotid area; scar hardly visible. Discharged from hospital April 22, 1920, in good condition.

Died one and one-half years later from recurrence of carcinoma.

(3) Mrs. D., age thirty-four, was operated upon February 27, 1919, at St. Vincent's Hospital for an adherent left ovarian cyst with torsion of pedicle and chronic appendicitis.

Second day following right parotitis began and during its progress patient's condition was critical. The systemic reaction was characteristic of a high grade of sepsis with meningeal disturbances; tense and stiff the muscles of the side of face and head with drooping of eyelid, associated with dysphagia, chills, high temperature and rapid, weak pulse were present. White count, 21,400. On sixth day gland was exposed and drained. Pus showed clear culture of staphylococcus aureus.

Discharged from hospital April 13, 1919, with ultimate and complete recovery.

Third Type or Gangrenous Parotitis.—Fortunately this type is rare. In a search of the literature on this subject, all writers report invariably a fatal result. The similarity of the incidence of the infection as in the other types, is noted in this protean of diseases. However, a higher leucocytosis, a greater systemic reaction, a greater local disturbance is also noted in its inception. The compactly arranged lobules of the gland, covered by the unyielding parotideo-masseteric fascia, favors the rapid development of gangrene.

Dependent upon the nature of the infective organisms, phlebitis and thrombosis develop early: ulceration of vessels with fatal hemorrhage may ensue; the surrounding structures become involved in the gangrenous invasion and death results from pyohæmia or sapræmia or septicæmia, intensified and hastened by the richness of the lymphatic and venous circulation.

Illustrative Case.—(4) Mrs. J. B. M., age thirty-six, suffering with an acute gangrenous appendix with perforation and abscess formation, was operated upon May 31, 1922. Her history disclosed she had suffered some past few months with a right parotitis of indefinite origin and of short duration.

Third day after operation elevation of pulse from 90 to 120, temperature from 100 to 103, beginning pain and swelling in right parotid, which increased rapidly in size. Delirium from the inception of parotid involvement with dysphagia. Two days later temperature 105, pulse 140, very delirious. Tumefaction increased to immense size. Parotid was immediately exposed by a long incision extending from zygoma down to the sternocleidomastoid muscles. Complete necrotic disintegration of gland had taken place with most foul odor. Cultures from the debris were negative as to organisms. Despite wide open drainage and the removal of the whole necrotic gland, the axillary temperature rose to 107, pulse fast and weak. Death ensued twelve hours later.

SUMMARY

1. Every post-operative parotitis is a potential lethal factor until it proves itself benign.

2. To await spontaneous evolution of parotitis is jeopardizing life.

3. Differential diagnosis of these types suggests at once the method of relief, medical or surgical.

4. When surgical, operate early, with free incision, and open drainage.

5. The greater the involvement of the face and neck structures, and especially in gangrenous parotitis, the greater the need for more thorough exposure.

6. The Y incision meets all indications. Extending from the zygoma in a curvilinear manner, following the sternocleidomastoid, to the supraclavicular region if necessary. Its posterior limb extending from the mastoid and joining it below the angle of jaw.

THE IMPORTANCE IN SURGERY OF THE THYROID GLAND OF THE CORRECT DIFFERENTIAL DIAGNOSIS OF THYROID DISEASES*

By Walter M. Boothby, M.D.
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During the last few years, clinical and laboratory workers have been giving more and more attention to refinements in the diagnosis of the various thyroid diseases. Only recently, the surgeon has become impressed with the importance of a correct differential diagnosis in order to show whether or not operation is indicated, the type of operation advisable, the influence of such careful differentiation on the results of operation, and on the mortality rate.

Plummer's classification of thyroid disease, which has been in use at the Mayo Clinic for several years, is based on structural, functional, etiologic and clinical characteristics which are correlated on fundamental grounds into nine distinct diseases: (1) diffuse colloid goiter; (2) adenomatous goiter without hyperthyroidism; (3) adenomatous goiter with hyperthyroidism; (4) exophthalmic goiter; (5) myxœdema; (6) cretinism; (7) myxœdema of childhood; (8) thyroiditis; and (9) malignant disease of the thyroid.

I shall confine my discussion to the first four of these conditions, as they are of particular importance to the surgeon, and shall emphasize the reasons why differentiation of the conditions is important in surgery of the thyroid gland.

Diffuse colloid goiter is a symmetric enlargement of the thyroid gland, characterized pathologically by an excess of colloid in the acini, and unassociated with symptoms of hyperthyroidism. Many patients with simple diffuse colloid goiter have increased vascularity or hyperæmia of the gland, and not infrequently thrills and bruit. On palpation the gland feels quite similar to that in typical exophthalmic goiter, and therefore, if the enlargement occurs in a nervous unstable person who has symptoms recognized as "effort syndrome" or "disordered action of the heart," a mistaken diagnosis of exophthalmic goiter is readily and unwittingly made. The basal metabolic rate is a great help in distinguishing these cases from exophthalmic goiter, because the rate is not only not persistently elevated in diffuse colloid goiter, but is usually somewhat below normal, while in exophthalmic goiter, with rare exceptions, it is more than 20 per cent. above normal.

Diffuse colloid goiter is much more common in certain regions, and where it is most common, it is usually more accurately diagnosed and possibly, therefore, less often needlessly operated on. In the very early stages of the disease the patients are greatly benefited by the administration of iodin and, later, of thyroid extract or thyroxin. Operation is indicated only if the goiter becomes

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excessively large and does not respond to medication; such failure of medication indicates that the enlargement may be due to colloid adenomatous tissue, and not to typical diffuse colloid goiter.

Patients with diffuse colloid goiter are safe operative risks; they also get well under medical treatment; therefore, the surgeon, by including the condition in the classification of exophthalmic goiter, will greatly reduce his mortality rate, and similarly the internist will increase the number of patients getting well under medical treatment. At the Mayo Clinic, no patient with diffuse colloid goiter and a normal basal metabolic rate has been operated on during 1922.

Adenomatous goiter without hyperthyroidism is a nodular enlargement of the thyroid gland which does not cause constitutional symptoms, nor alteration in the concentration of thyroxin in the body. This type of goiter, like diffuse colloid goiter, is endemic, and seems also to be due, in the main, to deficiency of iodine. In most cases these nodular masses are surrounded by a definite capsule, and even when without a capsule can often be recognized as true tumors, possibly originating from the embryonic tissue rests known as wolffian bodies; they are, therefore, grossly and developmentally different from the diffuse enlargement of exophthalmic and of diffuse colloid goiter.

Adenomatous masses, as a rule, do not respond completely to thyroid or iodine medication; in fact iodin is particularly dangerous in cases of long standing of adenomatous goiter without hyperthyroidism, because the iodine is likely to stimulate, or rather aid the adenomatous tissue to hyperfunction, and thus to precipitate the constitutional symptoms of hyperthyroidism with its attendant dangers. Kocher and others have repeatedly warned against the dangers of giving iodine excessively and indiscriminately to patients with goiters; in all probability the greater number of patients harmed belonged to this group.

Operation is indicated for adenomatous goiter without hyperthyroidism for cosmetic reasons, for the relief of pressure symptoms, and as a preventive measure against future hyperthyroidism. In order to estimate the probable risk to the patient, accurate distinction must be made between it and adenomatous goiter with hyperthyroidism. For this purpose the basal metabolic rate is of great help, because if it is within normal limits it excludes hyperthyroidism. During 1922 in the Mayo Clinic, thyroidectomy was performed on 663 patients for adenomatous goiter without hyperthyroidism, with only one post-operative death, a mortality rate by case of 0.15 per cent.

Adenomatous goiter with hyperthyroidism is a constitutional disease due to the presence in the thyroid gland of adenomatous tissue which, by maintaining an abnormally high and unregulated concentration of thyroxin in the body, causes an increased basal metabolic rate with the resulting secondary manifestations. Plummer was the first to recognize the condition as a distinct disease.

By studies of the effect of the intravenous injection of thyroxin on the myxœdematous patient, Plummer has shown that the level of the metabolism in the thyroidless individual, usually about 40 per cent., is elevated to and maintained at normal, if the normal concentration of approximately 14 mg. of thyroxin is established and maintained in the body. The symptoms produced by the administration of an excess of thyroxin are identical with those produced by hyperfunctioning adenomatous tissue, and, therefore, cases of adenomatous goiter with hyperthyroidism are probably due to an increase in the amount of normal thyroid secretion in the body, above that equivalent to 14 mg. of thyroxin.

From the surgical viewpoint, the fact that the constitutional symptoms are due to the activity of the tumor is very important, because it permits the surgeon to assure the patient, before operation, of almost certain cure, provided the disease has not lasted long enough to produce permanent and irreparable damage of the heart or other organs. The operative risk is, however, much greater than in cases of adenomatous goiter without hyperthyroidism, and may be higher than in cases of exophthalmic goiter. Some of the reasons for this higher mortality seem to be, first, that many of the patients are over fifty years of age, and second, that the location of the adenoma may be such that it will be necessary to dissect in the neighborhood of the recurrent laryngeal nerve, or in the thoracic cavity, with corresponding increase in the severity of the operation and the danger of post-operative complications in the respiratory tract. In the Clinic, during 1922, thyroidectomies were performed on 205 patients with adenomatous goiter with hyperthyroidism, with seven post-operative deaths, a mortality rate by case of 3.41 per cent. Failure sharply and accurately to differentiate adenomatous goiter with hyperthyroidism from that without hyperthyroidism will, of course, result in a very low mortality rate; 868 thyroidectomies for adenomatous goiter, with and without hyperthyroidism, were performed with eight deaths, a mortality rate of 0.93 per cent. However, from a mortality rate so estimated, there is comparatively little to learn, and it is presented here merely to emphasize the importance of correctly differentiating the various thyroid diseases in the compilation of mortality statistics, in order that accurate and sound deductions may be made.

Adenomatous goiter with hyperthyroidism is necessarily more common in regions in which endemic goiter is common. In regions in which goiter is not endemic, it is likely to be overlooked, especially if it happens to be a single small adenoma; under such circumstances the most common mistake is to interpret as primary, the secondary cardiac condition that is caused by the hyperfunctioning adenomatous tissue, the symptoms of which will disappear on removal of the tumor; the more severe cases are on the other hand usually mistaken for exophthalmic goiter.

Exophthalmic goiter is a constitutional disease, apparently due to excessive, probably abnormal, secretion of an enlarged thyroid gland with pathologically diffuse, parenchymatous hypertrophy and hyperplasia. The condition is

characterized by an increased basal metabolic rate and the resulting secondary manifestations, by a peculiar nervous syndrome, and, usually, by exophthalmos with a tendency to gastro-intestinal crisis of vomiting and diarrhœa. The cause of the altered pathology and disturbed function of the thyroid gland is not known.

I have called attention to the fact that, clinically, it is very important to exclude from this group of cases, cases of diffuse colloid goiter, and also to eliminate cases of adenomatous goiter with hyperthyroidism. Aside from the satisfaction of making a correct differential diagnosis, it is essential to exclude the latter group, because the onset, prospective treatment, type of operation advisable, and prognosis, as well as the etiology, differ in many respects in the two diseases.

In reply to the question: "If both exophthalmic goiter and adenomatous goiter with hyperthyroidism are due to an excess of thyroid secretion, can there be a differentiation into two diseases?" several hypothetical answers are possible, but the one held by Plummer as the most probable is briefly as follows:

The symptoms of adenomatous goiter with hyperthyroidism can be produced by the administration of an excess of thyroid extract or thyroxin; therefore, adenomatous goiter with hyperthyroidism is regarded as due to the presence in the body of an excess of normal thyroid secretion.

The symptoms of exophthalmic goiter, however, cannot in their entirety be produced by thyroid feeding. The symptoms which are not produced in characteristic form are exophthalmos, the typical gastro-intestinal crisis, the peculiar nervous phenomena, and finally the metabolic status, as a result of which a post-operative reaction may arise which terminates in death within about thirty-six hours. While probably never entirely absent, this post-operative reaction varies from one of negligible intensity to a reaction so severe that death results; the suddenness and unexpectedness of this reaction, and its occurrence in patients who appear in excellent condition, are exceedingly distressing. All of these symptoms which are characteristic of exophthalmic goiter can probably be explained on the assumption that the secretion of the thyroid gland is not only present in excess, but that it is also an abnormal product. Moebius was the first to suggest, in general terms, the possibility of a "pathologic activity of the thyroid gland"; his ideas and those of others, with regard to the mechanism involved, were necessarily indefinite and general; even at the present time, any detailed explanation must be considered tentative. Kendall, however, in his studies of the composition and synthesis of thyroxin has isolated many substances which have a graphic chemical formula, quite similar to that of thyroxin. He has found it particularly difficult to introduce iodin in the proper manner into what he designates as the thyroxin nucleus. If it is a difficult procedure in the test tube, conditions can be conceived which would render it difficult of synthesis by the thyroid gland, and one such condition might be insufficient concentration or availability of iodin. During the last year Plummer has shown, by a very extensive series of experiments,

that many of the most outstanding and characteristic symptoms of exophthalmic goiter disappear rapidly and with a high degree of regularity following the administration of iodin. Plummer's observations led him to postulate that, following the administration of iodine, there would be a decrease in frequency and intensity of the post-operative hyperthyroid crisis, and, as just reported by Plummer at the meeting of the American physicians, the correctness of the theory has received substantial confirmation by the almost complete disappearance of this most dangerous reaction following operations on patients with exophthalmic goiter, who had received iodin pre-operatively.

As has recently been emphasized by Richardson, it is important, in considering statistics on the mortality rate in thyroid surgery, to know whether or not they are calculated separately for patients who do and do not have hyperthyroidism, and whether or not they are calculated on the basis of the number of cases or on the number of operations. However, in a disease like exophthalmic goiter in which in many instances multiple operations are performed, extending over a period of several months, it is impossible to determine with absolute accuracy the exact mortality for a calendar year on the basis of the rate for each patient.

In making the report on the mortality rate following operation on the thyroid in 1922, the Division of Surgery of the Mayo Clinic adopted Plummer's classification. Regardless of the immediate cause of death, or the length of time after operation on the thyroid, all deaths occurring in Rochester were charged against the operation and included in the mortality calculation. C. H. Mayo and Pemberton report one thousand nine hundred eighty-three operations on the thyroid gland in 1922, with nineteen deaths, a mortality rate of 0.96 per cent. The mortality rate in cases of adenomatous goiter without hyperthyroidism for 663 patients is 0.15 per cent, and in cases of adenomatous goiter with hyperthyroidism for 205 patients, is 3.41 per cent. Eleven patients with exophthalmic goiter died following operations on the thyroid gland. In all, there were 1093 operations for exophthalmic goiter, a mortality, based on the number of operations, of practically 1 per cent. During the year, 633 patients with exophthalmic goiter were accepted as operative risks; on this basis the mortality rate by case from eleven deaths is 1.74 per cent. The mortality following thyroidectomy in exophthalmic goiter is 0.96 per cent.

PRIMARY SARCOMA OF THE ŒSOPHAGUS*

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A review of the literature shows that primary sarcoma of the œsophagus is a rare affection. Most of the cases have been regarded as pathological curiosities. Sarcoma of the pharynx, on the other hand, is not so uncommon and in various reports some of these cases have been confused with sarcoma of the œsophagus. The apparent rarity of sarcoma may be due in part to a lack of careful histological study of œsophageal tumors. Clinically there may be no difference in symptomatology between sarcoma and carcinoma of the œsophagus, and the annular, ulcerating types of sarcoma can only be differentiated pathologically by microscopic examination.

Fig. 1.—Showing position of polypoid sarcoma in the œsophagus.

To the previously reported cases we are able to add another, that of a polypoid, spindle-cell fibrosarcoma of the lower end of the œsophagus.

The patient, a Scandanavian farmer, thirty years of age, was referred to Dr. Harold Brunn by Doctor Gross of Eureka because of difficulty in swallowing and vomiting.

Past History is essentially negative. There was an injury to the right flank four years ago followed by continued bleeding from the right kidney.

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This was relieved later by some operative procedure on the kidney. This trauma had no relation to the present condition.

Present Illness.—Eleven months before death the patient began to have difficulty in swallowing with regurgitation of solid food. When the bolus of food was swallowed it seemed to meet obstruction in the lower part of the œsophagus. He has never had pain. There has been no hæmatemesis, but at times he vomited pieces of meat-like material suggestive of necrotic tumor tissue. The symptoms grew progressively worse. Vomiting was spontaneous without direct relation to eating. He lost thirty pounds in weight. He was first seen at the hospital six months after the first symptoms appeared.

FIG. 2.—Tumor reflected to show areas of ulceration in mucous membrane of the œsophagus.

Physical Examination at this time was essentially negative. The patient was very tall and thin. The Wassermann, urine and blood examinations were negative except for a slight leucocytosis. Fluoroscopic examination by Dr. Lloyd Bryan showed an obstruction in the lower third of the œsophagus with some dilatation above it. The bismuth gradually passed along almost surrounding the mass which nearly filled the œsophagus. The œsophageal wall had a definite smooth outline except at one place where the bismuth did not penetrate and which might be considered to be the origin of the tumor. The appearance was that of a polypoid mass and not a carcinoma.

While the patient was in the hospital he vomited several pieces of the tumor; some as large as the end of the thumb with a necrotic surface. These were sent to Doctor Rusk for pathological examination. Most of the tissue was necrotic, but in a few areas there was tissue composed of small cells of connective tissue type, with relatively broad nuclei and a very finely fibrillar intercellular substance giving the appearance of a myxomatous tissue. Occasional mitotic division of cells was observed. Relatively abundant thin-walled vessels were found running through the growth. Diagnosis: sarcoma, possibly myxosarcoma.

Following the expulsion of the tumor masses the patient was able to swallow solid food and his weight increased. The location of the growth seemed favorable for an extra-pleural operation, but after considering the type of growth and the high mortality from these operations it was decided to try radium treatment.

May 6.—A gastrostomy after the method of Witzel was performed under local anæsthesia. The reason for gastrostomy at this time was to allow intensive radium treatment and to guard against any difficulty in swallowing that might be encountered due to œdema following these treatments.

May 19.—Œsophagoscopy by Dr. Wallace B. Smith. The upper pole of the tumor measured 35 cm. from the incisor teeth. A section of the tumor was removed for further histological study and seven radium tubes were inserted into the tumor. Microscopic examination of this tissue showed the same type of growth as described above. The patient went home the latter part of May and shortly afterwards vomited large masses of the tumor tissue. He returned July 10 for another radium treatment and at this time was able to swallow solid food without difficulty and looked very much improved. A third radium treatment was given August 18, but this was not followed by expulsion of necrotic tumor masses and he again began to have increasing dysphagia. Operation was now advised but the patient refused to consider this.

FIG. 3.—Showing three abscesses in right cerebral hemisphere.

He returned to the hospital October 5, 1922, reporting that he had had two convulsive seizures while at home. He had again become cachectic and apathetic. In the hospital he was delirious at night. There was no fever.

Fluoroscopic examination now showed considerable enlargement of the tumor mass and the condition was considered inoperable. A few days before death he was walking about. A deep X-ray treatment was given, during which he had a convulsive seizure which began with twitching of the face and then extended over the entire body. Three days later, October 15, he suddenly died.

Abstract of Autopsy Protocol.—Healed gastrostomy. Adhesions about the

right kidney which is much smaller than the left. Fine fibrous adhesions between œsophagus and lower lobe of the left lung. Mediastinal nodes negative. A few patches of bronchopneumonia in the lower lobes of both lungs. Other viscera negative.

Œsophagus: Between the bifurcation of the trachea and the diaphragm the œsophagus bulges and palpation reveals a large tumor mass in this region. Incision made along the left side shows considerable tension over the tumor. There is dilatation with thickening of the walls above the tumor. The polypoid, kidney-shaped tumor measures 12.5 x 4.5 x 2.5 cm. It is attached to the posterior wall by a fibrous pedicle 6 x 1 cm. At the base of this pedicle the wall is thick, firm and fibrous and a nodule 1.5 cm. in diameter projects through the posterior wall. The lower pole of the tumor is situated 2 cm. above the cardia of the stomach. The surface is wrinkled and nodular with necrotic material on the surface. There is sloughing and necrosis in the centre so that the tumor has been almost completely bisected longitudinally through the upper three-fourths. The portion which is not necrotic is tough and elastic and on section shows a whitish, homogeneous structure. On the right lateral wall of the œsophagus opposite the upper half of the tumor there is an area of ulceration in the mucosa 6 x 2 cm. Just beneath the lower pole there is a similar ulceration 2 cm. in diameter. There are no metastases.

Brain.—There is thrombosis in the anterior portion of the superior sagittal sinus. When the dura is incised a large amount of thick, foul-smelling pus is found covering the entire right hemisphere. Abscesses are found in the right temporal lobe and in both frontal lobes. The right frontal lobe bulges against the falx with encroachment on the left frontal lobe. Cultures from these abscesses show pneumococci and Gram-negative bacilli.

Anatomical Diagnoses.—Primary polypoid sarcoma of the œsophagus. Disseminated foci of pneumonia (possibly embolic) in lower lobes of both lungs. Multiple brain abscesses with purulent meningitis. Thrombosis of the superior sagittal sinus. Healed gastrostomy.

Microscopic Examination.—Sections from a number of points in the tumor show it to be rather uniform in structure, made up of a tissue rich in cells that course in various directions. The cells are of spindle shape, fairly uniform in size, and have a fine intercellular framework of connective tissue. The nuclei stain deeply except in areas near the surface where they are swollen and vesicular. There are many cells showing mitotic division.

A section from the nodule at the base of the pedicle of the tumor where the growth has extended through the wall of the œsophagus shows the same type of cell as found in the main tumor.

Throughout the tissue there are many thin-walled blood-vessels and in some areas there is extravasation of red blood-cells between the tumor cells.

Some sections show extensive necrosis on the surface. Below the necrotic areas there is marked œdema of the tissue with swollen and fragmented cells. There is marked infiltration of polymorphonuclear leucocytes and plasma cells. Where the surface is not necrotic it is found covered with atrophic squamous epithelium. In no area does one find proliferation of these epithelial cells.

The brain abscesses and meningitis as terminal affections in this case are interesting and unusual. The infection probably originated in the ulcerated areas in the œsophagus, passing through the lungs without evidence of localization and setting up foci of infection in the brain. This is considered as possibly occurring about the time of and precipitating his first convulsions. A re-infection in the same manner was probably responsible for the terminal conditions that caused his death; namely, the foci of pneumonia and meningitis. Cerebral infec-

tion, as is well known, often happens in cases of bronchiectasis or lung abscess, and we believe the process here is somewhat analogous.

The lungs fail to show any evidence of old inflammatory reaction except fibrous adhesions between the lower lobes and the œsophagus in the region of the tumor. The course of the disease was afebrile and there was nothing clinically to suggest the brain abscesses and meningitis except the convulsions and transient delirium. The spleen, kidneys, heart and other viscera showed no signs of a general septicæmia either grossly or on microscopic examination so we must conclude that the infection was swept into the blood stream and localized in the brain without producing a general infection.

Table I shows the reported cases of primary sarcoma of the œsophagus.

In discussing Borrmann's case at the German Pathological Congress, Lubarsch mentioned a polypoid fibrosarcoma which he had found in the œsophagus of a horse. Orth referred to a case in the Berlin museum similar to that of Borrmann. M. B. Schmidt mentioned a case of rhabdomyosarcoma which came to autopsy in his clinic at Zurich.

In addition to the cases given in Table I the following cases have been discussed by various authors:

Oppenheimer reported a case as primary sarcoma of the œsophagus without microscopic studies. From the description this was apparently an aneurism of an œsophageal artery filled with a laminated clot.

In the cases of Körner, Albrecht and Paget the tumor arose in the pharynx.

In the cases reported by Rotschy, Perez, Kündrat and Schlagenhaufer the tumor arose in the mediastinum with secondary involvement of the œsophagus.

The case reported by Huismans was probably a primary sarcoma of the femur with secondary involvement of the œsophagus.

Kraus says that the case reported by Butlin was primary sarcoma of the tongue.

Von Hansemann reported a case of carcinoma-sarcomatodes of the œsophagus, but original report was not available.

An analysis of Table I shows the following:

Including our case, 35 cases of primary sarcoma of the œsophagus have been reported. The average age of these patients is 53.6 years. The condition is much more common in men. Where sex is given there are 26 men and 7 women.

Practically every case showed dysphagia due to stenosis or obstruction by the tumor. Pain was present in many cases, its location varying according to the site of the tumor.

In 24 cases the tumor occurred in the lower half of the œsophagus. It was found in the upper half in 8, in the middle in 1, and in 2 cases the growth involved both middle and lower part.

In 14 cases the growth was polypoid, in 12 nodular and diffuse, in 9 annular. Many in the last two groups showed ulceration.

TABLE I.

Primary Sarcoma of the Œsophagus.

Author	Age and Sex	Symptoms	Site of tumor	Morphology	Origin	Type	Metastases
1. Chapman	45 M	Dysphagia. Pain	Upper half	Nodular. Diffuse.	Submucosa	Spindle cell. Some round cells	Nodes about œsophagus.
2. Dubreuil	49 M	Dysphagia.	Upper half	Nodular. Ulcerated	?	Sarcoma	Nodes behind right clavicle.
3. Targett	70 M	Dysphagia. Pain	Lower half	Polypoid	Submucosa	Small round oval and spindle cells	None.
4. Stephan	4 M	Dysphagia. Dyspnœa	Lower half	Polypoid	Submucosa	Lymphosarcoma	None.
5. Shaw	38 F	Dysphagia	Upper half	Annular. Diffuse. Ulcerated.	?	Round and oval cells	Adjacent nodes, lungs and kidneys.
6. Rolleston	54 M	Dysphagia. Tumor in left hypochondrium	Lower half	Annular. Ulcerated. Stricture.	Submucosa	Round cell	Nodes in mediastinum and abdomen; to ribs, ilium and skull.
7. Wolfensberger	75 M	Dysphagia. Cough	Lower half	Polypoid	Muscularis	Rhabdomyosarcoma	Nodes along stomach.
8. Von Notthaft	84 M	Sl. dysphagia	Lower half	Hard nodule, size of walnut	Submucosa	Small spindle cell	None.
9. Ogle	50 M	Dysphagia	Middle	Polypoid	Submucosa	Large spindle cell	None.
10. James	? ?	Dysphagia	Lower half	Annular. Soft	?	Alveoli of spindle cells	Tongue and nodes of neck.
11. Livingood	55 M	Dysphagia. Sternal pain	Lower half	Nodular	Submucosa	Spindle cell	None.

12. Gastpar.....	54 M	Dysphagia. Pain	Lower half	Annular. Diffuse. Nodular	Submucosa	Large round and spindle cells	None.
13. Starck.....	64 F	Dysphagia. Sternal pain	Lower half	Diffuse. Ulcerated	Mucosa (?)	Large round cell. Some giant cells	Brain, lungs, pleura, ribs, liver, kidneys and abd. nodes.
14. Starck.....	41 M	Dysphagia. Pain. Hæmatemesis	Lower half	Annular. Diffuse	Mucosa (?)	Large round cell	Liver.
15. Reutter.....	42 M	?	Lower half	Polypoid	Submucosa	Spindle and giant cells	None mentioned.
16. Chiba.....	55 M	Dysphagia. Hemorrhage. Swelling neck	Upper half	Annular. Diffuse	Submucosa	Small round cell	? Cervical nodes.
17. Glinski.....	68 M	Dysphagia. Abd. pain	Lower half	Polypoid	Muscularis	Rhabdomyosarcoma	None.
18. Von Eicken....	39 M	Dysphagia. Pain. Fever	Lower half	Diffuse. Ulcerated	Submucosa	Spindle and giant cell	None.
19. Howard.....	51 M	Dysphagia. Vomiting	Lower half	Annular. Ulcerated	Muscularis	Myosarcoma	Adjacent nodes. Stomach.
20. Frattin.....	? ?	Dysphagia	Upper half in diverticulum	Nodular. Diffuse	Submucosa	Lymphangioendothelioma	None.
21. Lange.....	64 F	Dysphagia	Lower half	Polypoid	?	Spindle and large round cell	None.
22. Wegener.....	32 M	Dysphagia. Chest pain	Middle and lower half	Annular. Diffuse. Polypoid	Submucosa	Large round cell	Right lung. Mediastinal nodes.
23. Baur.....	69 M	Dysphagia. Pain in neck	Upper half	Nodule size of walnut	?	Melanotic spindle cell	None.
24. Frangenheim...	63 F	Dysphagia. Cachexia	Lower half	Polypoid size of hen's egg	Submucosa	Small and large spindle cells	Œsophageal and gastric nodes.
25. Joliat.....	62 M	?	Lower half	Nodular. Diffuse	?	Melanosarcoma	Liver and peritoneum.

TABLE I. (*Continued*).

Primary Sarcoma of the Œsophagus.

Author	Age and Sex	Symptoms	Site of tumor	Morphology	Origin	Type	Metastases
26. Donath.....	58 M	?	Lower half	Diffuse. Ulcerated	Submucosa	Small spindle cell	Mediastinal and gastric nodes.
27. Donath.....	52 M	Pemphigus. Pneumonia	Lower half	Polypoid	Submucosa	Alveolar endothelial sarcoma	Adjacent nodes.
28. Von Hacker....	70 M	Dysphagia. Abd. pain. Hæmoptysis	Lower half	Polypoid	Muscularis	Leiomyosarcoma	None.
29. Von Hacker....	46 F	Dysphagia. Pain	Upper half	Sl. polypoid. Ulcerated	Mucosa	Round and spindle cell	Cervical nodes and liver.
30. Borrmann.....	48 M	Dysphagia	Middle and lower half	2 polypoid tumors	Muscularis	Spindle and giant cells. Probably rhabdomyosarcoma	None.
31. Herxheimer....	67 M	Dysphagia. Chest pain	Lower half	Annular. Ulcerated	Submucosa	Carcinoma-sarcomatodes	None.
32. Rieke.....	46 M	Dysphagia. Chest pain. Cough	Upper half	Nodular. Diffuse. Ulcerated	Submucosa	Large spindle cell	Mediastinal nodes.
33. Bertholet.....	63 F	Ascites. Jaundice. Emaciation	Lower half	Nodular. Umbilicated	Submucosa	Small round and oval cells	Mediastinal and mesenteric nodes. Liver.
34. Hofmann.....	61 M	Dysphagia. Pain	Lower half	Polypoid	Submucosa	Large spindle cell	None.
35. Smith and Rusk	30 M	Dysphagia. Vomiting. Convulsions	Lower half	Polypoid	Submucosa	Small spindle cell fibrosarcoma	None.

It seems probable in all cases except the myosarcomata that the growth originated in the submucosa.

Classification according to type of cell shows, 11 spindle cell, 7 mixed spindle and round, 5 round cell, 5 myosarcomata, 2 melanosarcomata, 1 lymphosarcoma, 1 lymphoangioendothelioma, 1 endothelial sarcoma, 1 carcinoma-sarcomatodes, and 1 where type is not given.

Sarcoma of the œsophagus apparently grows more rapidly than carcinoma, but metastases do not seem to occur as frequently as one usually finds in sarcoma elsewhere in the body. In 17 of the above cases no metastases were found. In most of the others only the adjacent nodes were involved, in some, however, extensive metastasis occurred.

In the cases of Lange, Reutter and Frangenheim carcinoma of the œsophagus occurred as separate and distinct tumors coincident with sarcoma. In the case of Herxheimer the tumor was estimated as two-thirds spindle-cell sarcoma and one-third epidermoid cancer, and was called carcinoma-sarcomatodes.

In the cases of Shaw, Rolleston, Livingood, Reutter, Wegener, Baur and the second case of Starck the tumor had perforated the œsophagus with sinuses to trachea, bronchi or lungs with gangrene of the lungs in some cases.

In many cases gastrostomy was necessary, due to stenosis or obstruction in the œsophagus caused by the new growth. In only one instance, the second case of von Hacker, was resection of the œsophagus performed. The growth recurred in adjacent tissue in the cervical region and the patient died three months later of bronchopneumonia.

It seems possible that operation might affect a cure if the patient is seen early, especially in the case of the more slowly growing, polypoid fibro-sarcomata like or own case.

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TREATMENT OF HOUR-GLASS STOMACH BY DOUBLE GASTRO-ENTEROSTOMY*

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The object of this paper is to call attention to the value of a procedure which I think should be more often employed. Devised theoretically by Von Hacker and Weir and Foote,† it seems to be performed infrequently and is mentioned with apparent reluctance by the writers on hour-glass stomach.

While I can cite only two cases, the results, immediate and remote, gave the maximum satisfaction to patients and operator.

Case I.—(Previously reported by Webb, Annals of Surgery, October, 1917.) M. D., forty-two. Housewife. Admitted February 5, 1917, on account of epigastric pain, vomiting and loss of weight. In 1915, weighed one hundred twenty-one pounds. Now weighs about eighty pounds.

Present Illness.—Began two and one-half years before admission with epigastric pain accompanied by gaseous eructations, occurring about three hours after the noon-day meal and continuing until about eleven P.M. Symptoms gradually increased in severity. Pain relieved by vomiting and by taking sodium bicarbonate until about one year before admission, when these measures ceased to give relief. No hæmatemesis or melæna. Patient has recently noticed splashing in stomach and peristaltic movements in upper abdomen.

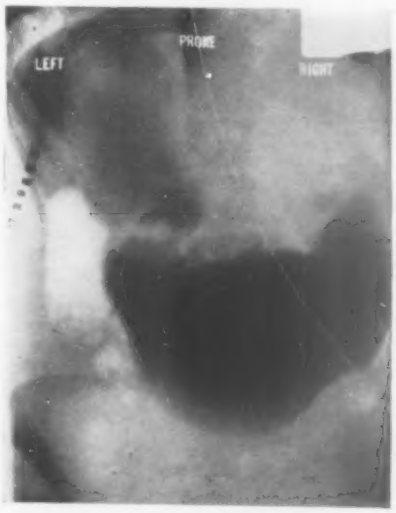

Fig. 1.—Rontgenogram of stomach before operation immediately after ingestion of bismuth, showing great dilatation of pyloric pouch. Position of photograph is reversed.

Physical Examination.—There is a bulging tympanitic area in upper half of abdomen corresponding to the position of a dilated stomach. Here peristaltic movements can be seen travelling from left to right and ending under right costal border. Clapotage present. There is a palpable movable mass about the size of a lemon just above and to the right of umbilicus. Wassermann negative.

Operation.—There is a huge stomach, the pyloric pouch three times the size of the cardiac pouch. The constriction between the two pouches is due to cicatrization of a large ulcer which forms a tumor nearly the size of a hand. Pylorus is obstructed by a similar large callous, apparently cicatrized, ulcer. A small node lying on the pylorus excised (microscopical report normal). Double

* Read before the American Surgical Association, May 31, 1923.
† Medical News, April, 1896.

posterior gastro-enterostomy is done, one in the cardiac pouch without clamps, using five rows of sutures, three posteriorly and two anteriorly, using silk for the first and last and fine chromic gut for the other three. The same loop of intestine is used five inches away for a second gastro-enterostomy in the middle of the pyloric pouch.

Subsequent Course.—Recovery uneventful. Sixth day taking soft-solid diet; tenth day sat up in a chair. Discharged March 5, 1917, free from symptoms.

Follow-up, May 7, 1917. Free from symptoms. Has gained thirty-two pounds. Barium series shows stomach empties rapidly, being nearly empty at the end of one hour and practically free from barium at the end of five hours. Both gastro-enterostomy openings are working well. (See Figs. 1–5.)

FIG. 2.—Röntgenogram of stomach before operation, taken twenty-four hours after ingestion of bismuth, showing retention in pyloric pouch.

Subsequent Notes.—January 30, 1919. Gained enormously in weight. May 1, 1922. Feels O. K. June 15, 1923. Recently mild gastric upset which patient attributes to disturbance of menopause. Weight same.

CASE II.—M. L. Female. Age, fifty-four. *Present Illness.*—Gastric manifestations since the age of eighteen, at which time attacks of pain with distention. These attacks come on three or four hours after meals, and patient has been in the habit of reducing pain by inducing vomiting.

Physical Examination.—Fairly well nourished. Abdomen shows distinct visible peristalsis over its lower part. Wassermann negative. Hæmoglobin 88 per cent.

Fluoroscopic Examination.—(By Dr. A. L. Holland.) Large hour-glass stomach, cardiac pouch a little the larger. The upper pouch empties fairly quickly. The pyloric pouch shows a marked retention at the end of thirty hours. There is also a pyloric ulcer with marked obstruction (Fig. 6).

Operation.—(April 26, 1922.) Stomach very large and divided into two pouches. Opening between the two is about the calibre of small intestine. The pyloric pouch is drawn out into the duodenum, both being distinctly smaller calibre, apparently from distortion, as there is no constriction. There is also a Harris band which is separated and some adhesions of the duodenum to the liver. The cardiac pouch is altered; structure seems to be for the most part thick, somewhat indurated, and of whitish appearance. Two gastro-enterostomies are done in the same loop of intestine. Openings are made about two inches and seven inches from the fossa of Treitz as in Case I. Time one hour and twenty minutes.

Convalescence.—Most uneventful. Highest temperature 100°. Never vomited. Discharged May 17th, eating quite substantial diet. Entirely free from any gastric disturbance.

Follow-up, September 27, 1922. In excellent health and reports herself free from any gastric symptoms ever since operation. Gained 25 pounds.

June 14, 1923. "Have been well all winter and able to eat as I never have before."

It is hard to understand why so simple and logical an operation as double gastro-enterostomy is so seldom employed. It seems particularly called for

when, as so often happens, an additional juxta pyloric ulceration causes an actual or potential obstruction. The possibility of overlooking this pyloric stenosis should render us very cautious in confining ourselves to some of the plastic operations (Fig. 7, types I, II, and III); or the anastomosis of the pouches with each other (Fig. 7, types IV, and V). If we do not perform any plastic operations or some form of gastro-enterostomy, there remains then some type of resection (Fig. 7, types VI and IX). In general it may be stated that resection in the hour-glass stomach is to be avoided if the condition can be adequately dealt with otherwise, for the following reasons:

1. The hour-glass stomach is the end result of a long-standing, particularly severe gastric ulceration and most of the patients are greatly debilitated and poor risks.

2. Any form of resection has a definite risk of being followed by any of the varieties of pneumonia.

3. Gastro-enterostomy may very often be performed with great ease under local anæsthesia, particularly if the abdominal wall is thin and lax and the stomach is large, or ptosed, as it generally is in emaciated patients.

4. Other operations of less severity give good results.

FIG. 3.—Röntgenogram of stomach three months after operation, showing hour-glass contracture and bismuth in both pouches. Position in photograph is reversed.

I have never seen any unfavorable reports following the performance of double gastro-enterostomy. It is possible that to many operators the term "double gastro-enterostomy" means some much more complex procedure than the one used by me (Fig. 7, type VIII), namely typical, no-loop, posterior anastomosis in the same loop of jejunum, the second opening being made wherever the second pouch can be conveniently drawn through a separate opening in the transverse mesocolon, three inches to six inches from the first.

To some the procedure may seem illogical, that the outflow from the first gastro-enterostomy may enter the stomach through the second opening. Admitting for the sake of argument that such a reflux takes place, does it do any harm? Certainly the uneventful convalescence of the cases reported with their splendid after results controvert any theoretical objection. Moreover, if there is any validity to the belief that an alkaline dilution of the acid gastric contents favorably influences or prevents ulceration, the lower pouch and pyloric outlet cannot but be benefited by the intestinal reflux.

In the United States there seems to be a tendency to employ more and more the sleeve (meso-gastric) resection. The principal advantage claimed

is the removal of a cancer which may simulate the typical hour-glass deformity, or as a prophylaxis of its development. It seems to me that the possible cure of such a cancer must be doubtful. The margin of the resected area is not usually sufficiently wide, and the area of lymphatic drainage toward the pyloric end persists. Some operators have abandoned sleeve resection because an artificial hour-glass has resulted from the narrowing of the anastomosis.

The indications for resection are lessened if we remember that cicatrization represents the healing of an ulceration. The process itself is usually extinct and only its mechanical aftermath has to be considered.

If the lower pouch is very small and particularly if the hour-glass constriction is very tight, a single gastro-enterostomy in the upper pouch may

FIG. 4.—Röntgenogram of stomach three months after operation, taken one hour after ingestion of bismuth, showing both gastro-enterostomy openings working well. Position in photograph is reversed.

FIG. 5.—Röntgenogram of stomach three months after operation, taken five hours after ingestion of bismuth, showing stomach practically empty. Position in photograph is reversed.

suffice in the absence of a pronounced pyloric stenosis (Fig. 7, type VII). In such a condition any form of gastro-enterostomy, posterior, anterior, or anterior retro-colic in the lower pouch might be difficult or functionally imperfect. In such a case, posterior gastro-enterostomy in the large upper pouch may be expected to work well. For instance, one of my patients had a large visible and palpable tumor of the pyloric end of the stomach. Operation showed a large, irregular mass, presenting every appearance of a carcinoma, causing hour-glass deformity with an extremely small second pouch. A posterior gastro-enterostomy in the upper pouch resulted in a good convalescence and subsequent disappearance of the mass.

In conditions such as described, if absolute necessity existed for dealing with a small second pouch, a pylorectomy would probably be best performed. I should feel, however, in poor risks that the operation might be done in two stages, placing the gastro-enterostomy so as to allow eventually of resection.

T. T. Thomas, British Journal of Surgery, vol. ix, has made one of the

most interesting and valuable contributions to the treatment of hour-glass stomach. Some of his observations markedly confirm the complexity of the condition and give valuable hints. In his fifty cases the following procedures were used:

1. Gastroplasty, 7.
2. Gastro-gastrostomy, 15.
3. Posterior gastro-enterostomy in proximal pouch, 14.

FIG. 6.—Print of X-ray plate of hour-glass stomach before operation. (Case II.)

4. Double posterior gastro-enterostomy, 2.
5. Retrocolic anterior gastro-enterostomy, 3.
6. Anterior gastro-enterostomy, 3.
7. Gastro-duodenostomy in proximal pouch, 1.
8. Retrocolic anterior gastro-enterostomy in proximal and posterior gastro-enterostomy in distal, 1.
9. Partial gastrectomy, 2.

The mortality is 14 per cent. The end results by any method were good, showing wise judgment in applying the method best suited to any given condition. It is interesting to note that a resection was performed only twice; still more so, the success attending the plastic operations and anastomoses. Personally, I have had rather a prejudice against these latter operations,

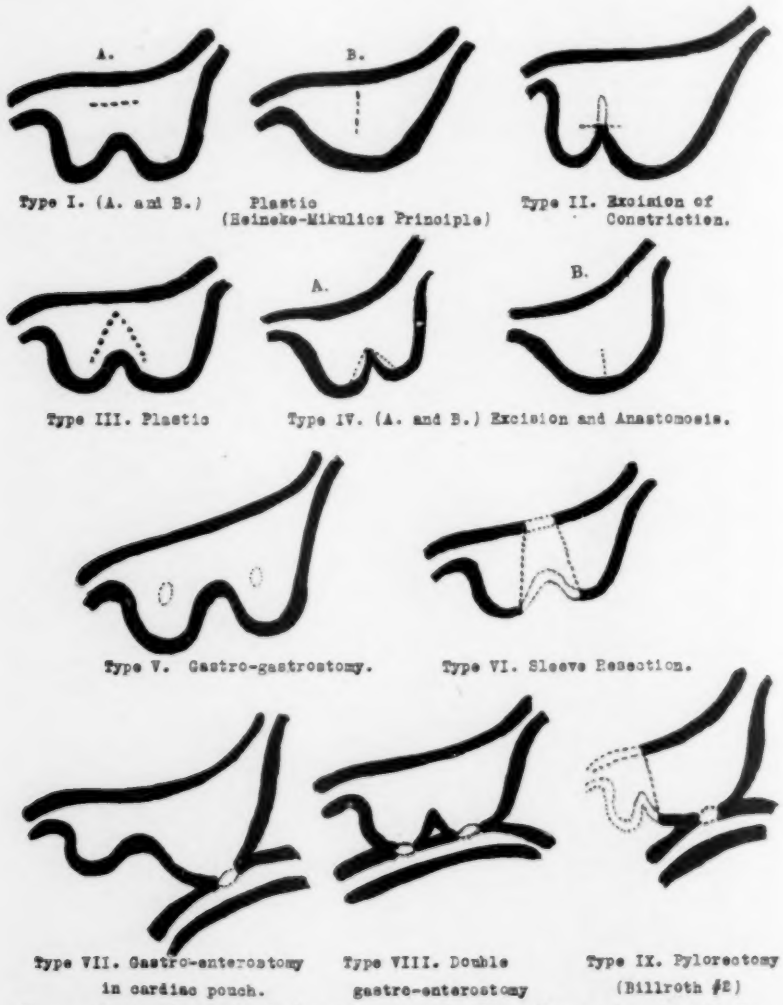

FIG. 7.—Types of operation for hour-glass stomach. These diagrams have been kindly furnished by Dr. Clay Ray Murray, Deputy Assistant Surgeon, New York Hospital.

having had some poor results while other forms of treatment have been successful.

Thomas says, "There is no condition in surgery that may call for so great a variety of procedures to deal with the degrees and complications met with; and although the radiographic evidence affords valuable help, it is impossible in any given case to have the slightest idea beforehand what surgical manœuvre will be resorted to."

The accuracy of the above statement was illustrated in a case of trifid

stomach (Fig. 8) occurring early in my experience. The reproduced X-ray picture was outlined by the röntgenologist only after the post-mortem had demonstrated the complexity of the condition.

In conclusion I would call attention to the hint furnished by the size of

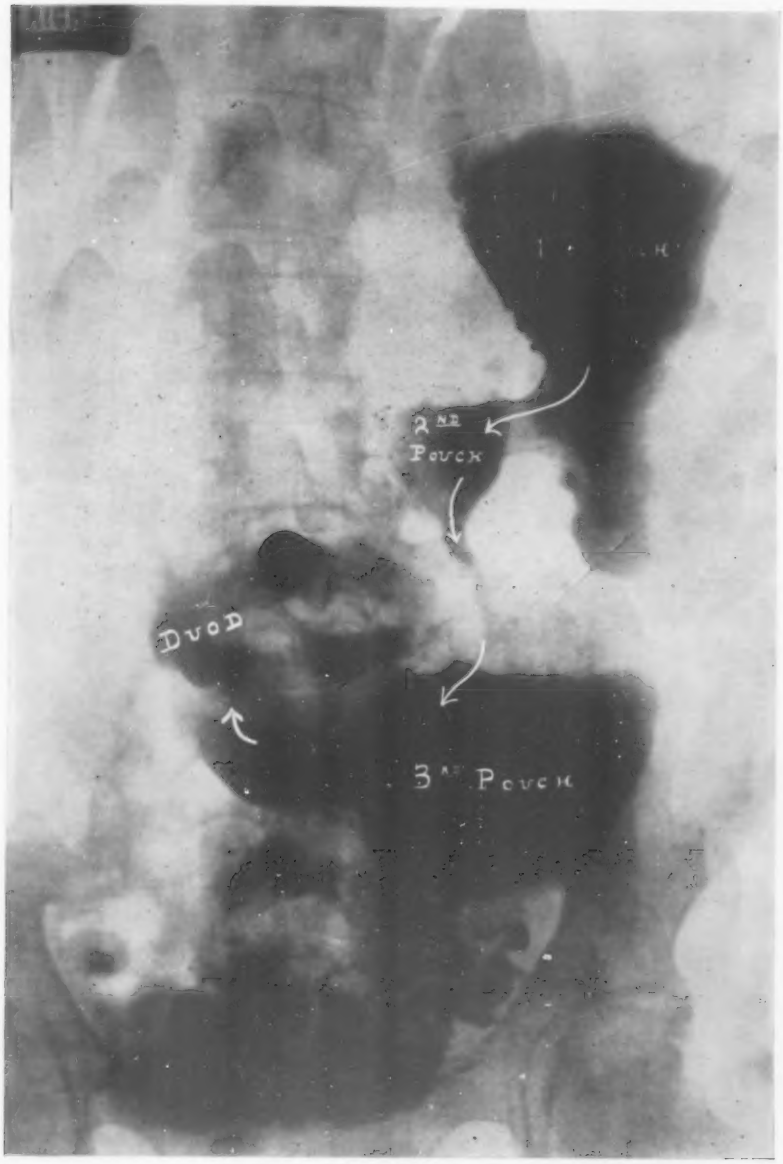

FIG. 8.—Print of X-ray plate of trifid hour-glass stomach.

the lower pouch, as regards the presence of a second obstruction at the pylorus, and it is in these cases where the stomach is divided into pouches of different sizes, or the lower pouch is distinctly large, that the operation of double posterior gastro-enterostomy is particularly indicated.

HYPERCHOLESTEROLEMIA

REPORT OF A CASE TREATED BY BILE DRAINAGE

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of New York, N. Y.

In previous communications the relationship of the cholesterin metabolism to cholelithiasis and disease of the biliary tract was exhaustively considered. In several of these reports reference was made to a complex of symptoms, referable to the right hypochondrium, which were observed to be associated with an hypercholesterolemia in the absence of any demonstrable stone formation or obstruction in the terminal or other part of the duct system, and in the absence of any complicating condition, such as atherosclerosis, nephritis or glycosuria with a hypercholesterolemia frequently coexists. A case of this kind is reported herewith, in which the condition was recognized before operation, in which the diagnosis was substantiated during an exploratory laparotomy, in which surgical therapy was undertaken with the distinct object of curing, or, at least, relieving the disturbance of metabolism leading to the hypercholesterolemia, and in which a symptomatic cure followed.

The remarks, which follow, have reference exclusively to conditions of pure hypercholesterolemia, in which the complicating factors—obstruction, nephritis, atherosclerosis, diabetes, etc.—play no part unless otherwise indicated in the text.

CASE REPORT

J. B., six years before the patient's first admission to Mt. Sinai Hospital, she had been treated for trigeminal neuralgia. Pain had been present for two years. There were no gastric, or, in fact, any abdominal symptoms of any kind at this time. A symptomatic recovery was made. There is no knowledge concerning the condition of the cholesterol metabolism of the patient at this time.

The patient was first admitted to the hospital (1919-33-1) in December, 1918, for the cure of an umbilical hernia which had given annoying symptoms since the birth of a child two years previously. There were no symptoms at this time which could be definitely referred to the stomach, liver or bile passages. The operation, a Mayo hernioplasty, was followed by uneventful healing of the wound; the convalescence, however, was disturbed by a phlebitis in the left leg. No blood examinations were made at this time. The second admission (1919-61-186) of this patient was in October, 1919. At which time her chief complaint was gastric distress: "heaviness" in epigastrium, duration, 10 months.

Previous history, born in Russia, age fifty-seven years, housewife, married. Has had eleven children of whom four are living and in good health; the cause of death in the others is not known. Menopause, four years ago. Has headaches at times. No cough or dyspnœa on exertion. The bowels are constipated. Usually she has a poor appetite. Some nocturia.

Present illness. The present symptoms began ten months ago directly following the operation for the hernia. There is a continuous heavy feeling in the epigastrium which becomes aggravated after the taking of food. There is no

vomiting of food or other material, or eructations of gas. The pain begins in the epigastrium and radiates to both costal arches. Anorexia is still present and the bowels are constipated. At no time has there been any jaundice. The stools have apparently been normal as far as the patient can tell.

Physical examination. The general condition of the patient is good. There are no evidences of any acute illness. The head is well formed and shows no abnormalities. The ears and mastoids are negative. The eyes show no external abnormalities; vision is good with glasses; the pupils are equal and regular; the pupils react to light and accommodation. The conjunctivæ are not icteric. The oral and nasal cavities show no abnormalities. The teeth are in good condition. The tonsils are not enlarged and appear normal. There is no enlargement of the cervical lymph glands. The thyroid is not enlarged. The chest is of normal shape. The lungs are clear throughout and no abnormalities are distinguishable. The heart is not enlarged to percussion. The apex beat is not seen or felt. The action of the heart is regular and of satisfactory quality. There is a soft blowing systolic murmur at the apex transmitted to the axilla. The pulse is of good quality and tension.

The abdomen is pendulous and soft. No masses or tender points are made out. In the region of the navel there is the scar of the hernioplasty which is well healed and in which there is no recurrence of the hernia. The liver, spleen and kidneys are not palpable. The vaginal examination showed the uterus enlarged to the size of a three months pregnancy, the substance of it being hard and nodular. The rectal examination was negative. The extremities are normal with the exception of marked varicosities of the lower legs. The reflexes are present and equal on both sides. Systolic blood-pressure was 110 mg. Hg; diastolic, 85. Urine negative.

The nature of the underlying disturbance was suspected immediately. A number of questions arose. In December, 1918, when the patient was operated upon for the umbilical hernia, there were no symptoms which could in any way be referred to the liver or the cholesterol metabolism. However, symptoms, which are distinctly referable to the liver and the cholesterol metabolism, began within so short a time after the operation as to make one believe that some factor in the operation had acted as an etiological cause either to call forth these symptoms as something entirely new, or to excite into activity a dormant condition.

The etiological factor was most likely the anæsthesia. Anæsthetic drugs, ether less markedly than chloroform, are known to cause destructive changes in the liver cells. These changes occur in a small proportion of the cases and in widely different degrees. Even without anatomical change, the anæsthetic drug undoubtedly has an inhibitory effect on the functional activity of the liver cell leading to an interference with the normal capacity of the liver in storing, handling and excreting cholesterol bodies; and the natural consequence of such disability is an unusual retention of cholesterol in the blood stream.

There is evidence to show that an hypercholesterolemia may exist without subjective symptoms. The probabilities are strong that in individuals in whom this diathesis is present, especially when such abnormality has its most common inception in a physiologic purpose (pregnancy), a certain amount of physio-

logical adaptation takes place so that moderate degrees of hypercholesterolemia are tolerated without the exhibition of any subjective symptoms. Only when the hypercholesterolemia reaches an extreme degree do symptoms appear. Possibly this accounts for the large number of patients in whom an hypercholesterolemia is present without any assignable cause and in the absence of any nephritis, atherosclerosis or diabetes. It seems not unreasonable to assume that the capacity for tolerance or adaptability for this disease should not be materially different from that present in other conditions of a similar order. When for any reason the retention of cholesterol bodies becomes extreme and beyond the capacity of the individual's adaptability, then subjective symptoms appear. The probabilities are strong that this happened in our patient.

The operative notes are as follows:—November 15, 1919. Exploratory laparotomy. Pericholecystic adhesions. Cholecystostomy. Fibroid uterus. Through an obliquely placed right rectus incision in the upper right quadrant of the abdomen, the peritoneal cavity was entered. The liver is normal. The gall-bladder of normal size, of normal blue color, contains no stones and the contained bile is easily expressible into the ducts. There are a moderate number of thin filmy adhesions between the gall-bladder and the adjacent viscera. The cystic, the hepatic and the common bile ducts are normal in every way and contain no stones. There is a fibroid condition of the uterus corresponding to the description in the physical examination. The rest of the abdominal organs are normal. A typical cholecystostomy was done, the tube being fastened into the apex of the gall-bladder with several purse-string sutures. The abdominal wall was closed tightly around the tube.

The post-operative notes are:—There was good recovery from the operation. The discharge of bile through the tube was profuse. At first the escaping bile was of a dark greenish-black color; very quickly this lightened considerably and within a week the bile was clear and of a golden-yellow color. It continued so until the drainage ceased and the wound closed. The wound was dressed in the usual way. With the exception of the drainage tract it healed by primary union. There were no complications of any kind during the healing of the wound and the convalescence. The patient was discharged cured on December 17, 1919.

The presence of pericholecystic adhesions has furnished material for discussion on many occasions. When the evidences of any previous exciting lesion are discernible, no difficulty is had in ascribing to the adhesions their proper interpretation. However, it is frequently difficult to say with any degree of certainty whether the adhesions are the scars of preëxisting lesions of the gall-bladder or of neighboring organs. Certainly adhesions of this kind can result from either. Occasionally the reason for the existence of these adhesions is not demonstrable at all.

In some previous unpublished studies it was possible to make out microscopically, crystals of cholesterol, or of other lipoid, in the wall of the gall-bladder, or, grossly, upon its mucous surface, when there was no other abnormality to be seen. At that time it occurred to me that under proper conditions such deposits, however small they may be, could become sources of irritation. Such irritative lesions would be very apt to cause fine pericholecystic adhesions

such as were seen in this patient without any other morphological change in the gall-bladder wall itself. A bile loaded with an excess of cholesterol would furnish a ready source from which these minute cholesterol crystals would be derived.

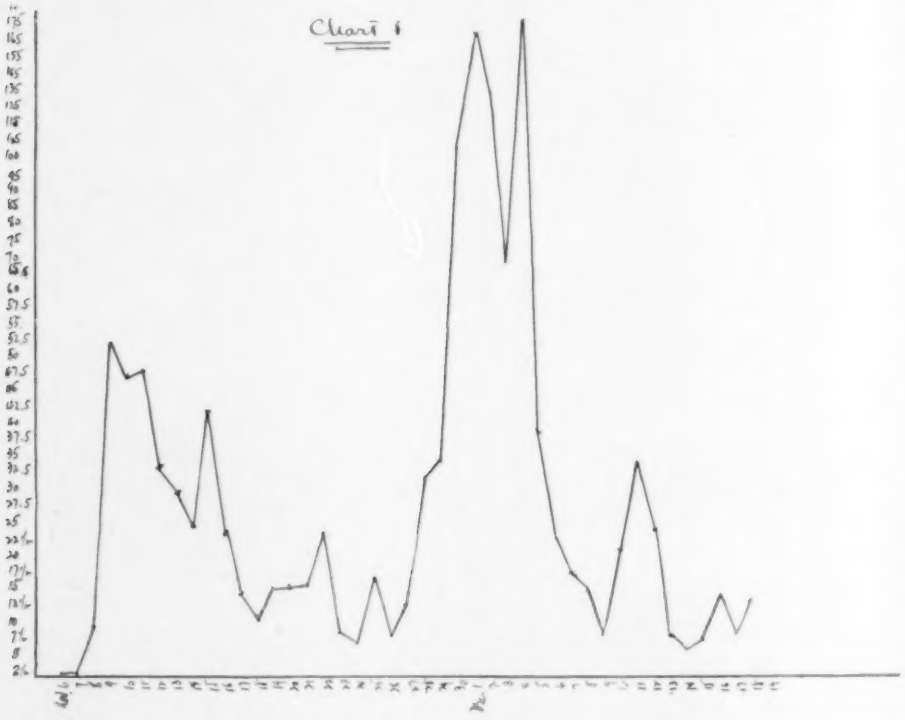
The following table and charts summarize the studies made on this patient directly after operation. TABLE I includes the post-operative facts in

TABLE I.

Date	Temp.	Diet (gms.)			Blood Cholesterol mg. per cent.	Bile Cholesterol		Biliuria
		Protein	Fat	Carbohydrate		c.c.	mg. per cent.	
Pre-operative								
October 29	99.				0.242			
November 5	100.2				0.470			
Post-operative								
November 6	101.6			1.2	0.436			0
7	101.6	11.7	1.7	269.3		190	0.197	0
8	100.	31.5	9.	144.8		270	0.032	
9	100.	28.4	52.3	164.2	0.290	170	0.043	
10	100.	76.1	48.5	247.5		230	0.04	
11	100.	29.	34.6	77.5		200	0.055	
12	99.8	51.2	30.	253.	0.190	300	0.052	0
13	99.6	45.2	26.	34.6		380	0.052	
14	99.4	93.	42.2	124.2		350	0.069	
15	99.4	38.4	23.4	42.2	0.182	96	0.088	
16	99.2					335		Mg. per cent.
17	99.6	27.7	14.3	86.1		325	0.052	Urea N, 30.8
18	99.8	35.	11.4	205.		225	0.064	Incoag. N, 61.
19	99.8	39.4	15.4	206.1	0.178	500	0.087	Uric acid, 2.2
20	99.5	39.4	15.4	206.1		325	0.064	Creatinin, 1.4
21	99.5	42.8	16.5	271.		250	0.08	
22	99.5	82.1	22.6	266.1	0.170	290	0.075	
23	99.6	53.9	8.2	382.4		300	0.082	
24	99.6	59.1	7.	302.5		230	0.08	
25	100.	79.3	17.9	403.		260	0.093	
26	98.8	56.5	8.6	341.5	0.170	220	0.062	
27	99.4	97.6	12.8	381.7		190	0.034	
28	99.	93.2	32.3	282.4		145	0.026	
29	99.	54.6	35.9	184.4		110	0.026	
30	99.2	98.5	100.8	297.4	0.248	210	0.014	
December 1	99.2	112.	178.8	297.1		305	0.018	
2	99.5	100.3	137.6	281.5		270	0.023	
3	99.6	95.6	76.4	196.8		160	0.026	
4	100.	107.6	180.	398.7		250	0.015	
5	99.5	89.8	40.5	268.2	0.230	170	0.013	
6	99.2	84.8	21.4	506.		225	0.016	
7	99.5	89.8	16.3	381.4		220	0.017	
8	99.2	78.	9.4	500.2		200	0.019	
9	99.6	57.8	22.	382.7	0.308			
10	99.	71.	34.8	364.8	0.218			
11	99.	75.3	34.7	557.3				
12	100.2	36.8	25.	532.8	0.218			
13	98.8	68.4	8.9	77.1		?	0.019	
14	98.6	54.9	6.3	301.3				
15	99.6	78.	8.1	488.3				
16	100.2	93.8	13.8	458.3	0.172			
17	100.	24.	8.5	505.8				
18	98.	102.4	15.9	719.3				
19	98.8				0.218			

regard to the changes in metabolism as shown in the blood and bile and the daily food content of fat, proteid and carbohydrate. At no time was there any evidence of any nephritis; and the blood-pressure was always within the normal limits. No abnormal glycosuria or glycolemia was ever demonstrable.

CHART 1 is a graphic representation of the daily variations in the fat content of the diet. In the first two days after operation, the diet contained no lipoid. Thereafter a moderate amount of lipoid was permitted in the food. Then this was purposely and progressively reduced until the twelfth day after

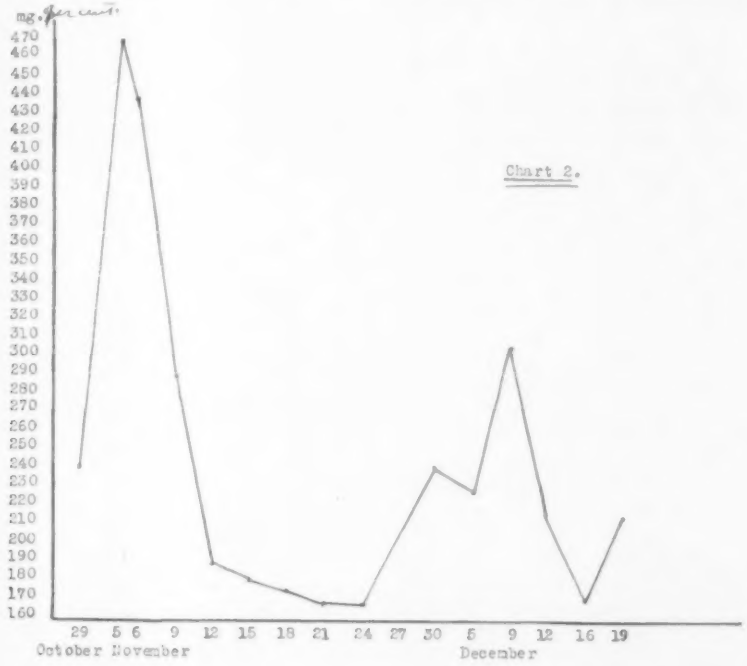


operation when minimum quantities of fat were being taken by the patient; this latter state continued for another nine days. Then large quantities of fat were given for nine days more with the purpose of demonstrating the change which was expected to follow in the cholesterol content of the blood and bile. In the final period the lipoid content of the diet was again diminished to minimum amounts.

CHART 2 is a graphic representation of the post-operative daily variations of the blood content of cholesterol. At the time of operation the patient was apparently in an hypercholesterolemic crisis as shown by the abnormally large amount of cholesterol in the blood. Within the week following the operation and the institution of bile drainage, the cholesterol content of the blood fell quickly to the normal level. The fall to this low level in so short a time was undoubtedly entirely due first to the character of the diet in which only minimum quantities of lipoid were permitted, and secondly to the drainage of bile

which removed from the body, large amounts of cholesterol daily. Corresponding with the period in which the fat in the diet was increased to a large extent, the blood content of cholesterol rose until it reached almost 300 milligrams per cent.

CHART 3 is a graphic representation of the daily post-operative variations of the output of cholesterol in the bile. At the time of operation the bile was saturated with cholesterol bodies as shown by the first bile determination, 0.197 milligrams per cent. The patient was in the midst of her hypercholes-



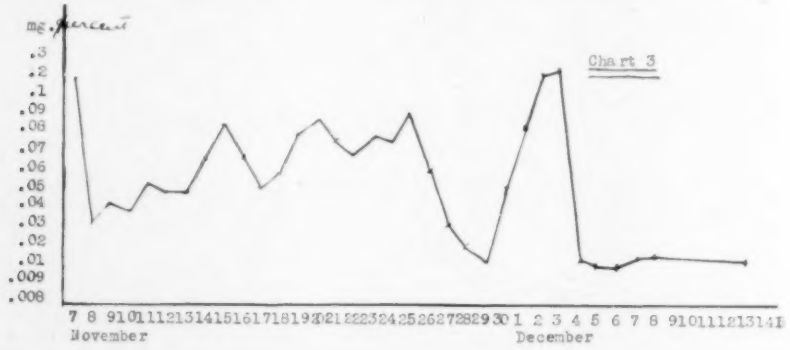
terolemic crisis. Immediately after operation there was a marked fall in the amount of cholesterol excreted in the bile. This was due to the toxic effects of the anæsthetic liberated in the liver cell environment which led to an inhibition of cellular activity. This laboratory observation corroborates the statement previously made in accounting for the beginning of symptoms after the operation for the umbilical hernia. The observed inhibition was a most temporary phenomenon and almost immediately it began to lose its effect, and the escaping bile showed a progressive increase in the amount of cholesterol excretion. Within a few days this reached a fairly constant level. At this constant level the bile was removing from the body slightly more than the quantities of cholesterol normally found in the bile. It, therefore, must correspond to a condition in which the body is very liberally supplied with cholesterol.

The period in which the excretion of cholesterol in the bile remained at this constant level corresponded to the period in which the lipoid content of the food

was at a minimum. Towards the end of the period, the output of cholesterol in the bile fell to a level which is within the normal range, or slightly below it. In the absence of any replenishing supply in the food, it indicates that the supply of cholesterol in the body was approaching its normal amount, or that, possibly, the available supply was somewhat less than it should be.

Just at this time large amounts of fat were permitted in the diet and, corresponding with this increase, the amount of cholesterol excretion in the bile rose immediately to the constant level referred to previously. This indicates that the body was again liberally supplied with cholesterol.

As soon as the excess of lipoid bodies had been removed from the food and excreted in the bile and the food again contained a minimum of lipoid, the daily amount of cholesterol appearing in the bile dropped back to the exact low level at which it had been before the feeding experiment was begun.



Apparently, in this regard the excretion of bile cholesterol was a sensitive index of the amount of lipoid in the food and, secondarily, of the amount of cholesterol in the body. It seems fair to assume that the variation in cholesterol excretion between the high and low levels as demonstrated in the experiment, and, graphically, on the chart, is the limit of physiological compensatory effort in the handling of lipoid material in the metabolism of the body. These facts are true at least in this subject; and, in comparing the facts with those obtainable in animal experiments, it seems fair to assume that they would be universally true in other subjects.

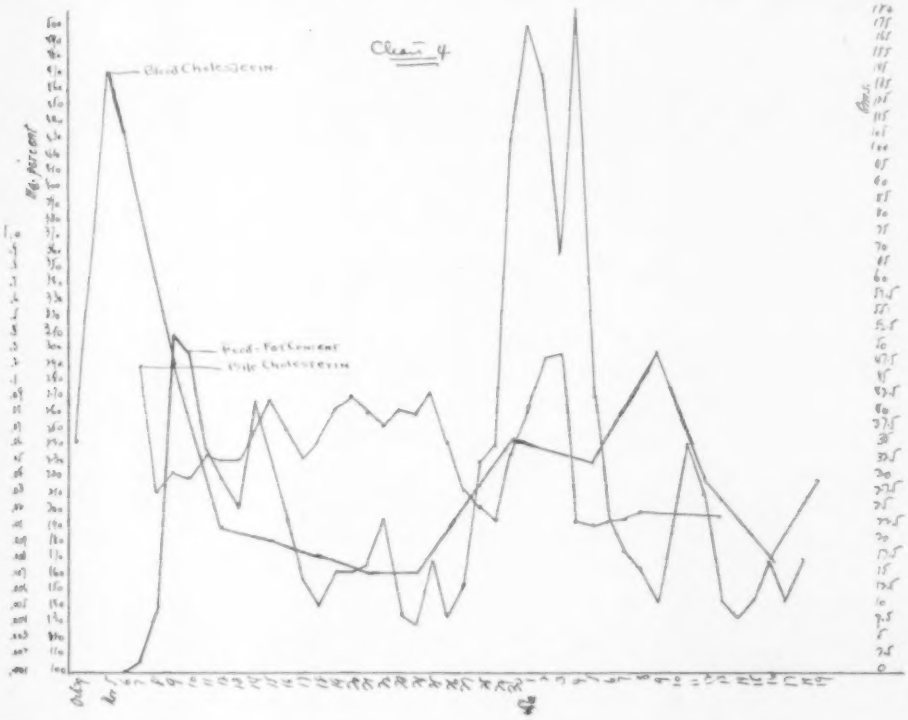
CHART 4 contains the three curves referred to previously, cholesterol in the food, blood and bile, arranged together for immediate comparison.

A most interesting phenomenon occurred during the experiment. It will be noted from the charts that (1) the rise of the cholesterol content of the blood following the increase of the fat content of the food was only a little more than 60 per cent. of that which had been present before operation and during the hypercholesterolemic crisis; and (2) the daily output of cholesterol in the bile during the experiment was equal to that during the hypercholesterolemic crisis before operation. The significance of these observations is as follows:

The cholesterol cycle includes (1) a source of supply—the food; (2) an

unknown factor probably existing in the liver cells, the result of whose action is demonstrable in the cholesterol content of the blood and of the bile; (3) excretion in the bile, the excreted cholesterol forming an additional source of supply in the intestine to that in the food.

In the experiment which was carried out, the source of supply in the food was controllable. Two facts are noted: (1) as the daily intake of fat in the food was increased, the daily excretion of cholesterol in the bile rose from the very low level which it had previously reached to the high level at which it had



been during the hypercholesterolemic crisis before operation. Apparently there was no difference in physiological effort between the excretion during an artificially produced period of plethora caused by increasing the amount of fat in the food, and that existing under the abnormal conditions of the hypercholesterolemic crisis. Inasmuch as the excretion factor in the cholesterol cycle is equal under both of these conditions, it seems correct to assume that the excretion factor was not the one primarily at fault in the production of the hypercholesterolemic crisis.

The marked difference between the cholesterol content of the blood during the hypercholesterolemic crisis before operation and that following an increase in the main source of supply (the food) indicates that the latter, at least in this patient, played only a subsidiary and unimportant part in the disturbance of metabolism which led to the retention of cholesterol in the blood. Some other factor must have existed in the liver parenchyma which was of primary

importance. And the studies of Oertel, to which the views of Stadelmann and Eppinger, Jr., seem applicable, seem to show that some unknown activity liberated in the liver cell environment causes specific changes in the cell protoplasm leading, probably, to a decreased production, or, at least, to a lack of proper discharge of bile into the biliary passages and to a resultant retention of bile components in the blood stream. Just what this unknown activity may be I purpose discussing at another occasion.

It is noted in the charts that the observable manifestations in the blood took place appreciably later than the increase of the supply of fat in the food, while that in the bile was concomitant. The liver must, therefore, store up an excess of lipoid. The blood crisis occurs, most probably, only when the capacity of the liver for storing cholesterol is overtaxed. This undoubtedly explains the fluctuations in the cholesterol content of the blood, especially for those times and periods in which a large excess (cholesterol crisis) is retained in the blood stream.

There are many factors which, to my mind, point clearly to the fact that the disturbance of metabolism leading to an hypercholesterolemia is a fatigue phenomenon. Rest corresponds to the period of normal cholesterolemia. In times of superabundance, the release from the body of any excess of cholesterol beyond the quantity which the body, in a healthy state, can normally handle favors the recuperation of the fatigued function and restores the metabolic activity to a normal state. Such restoration to normal active conditions—*i.e.*, the removal of excess quantities of cholesterol, can be accomplished by the drainage of bile, or by the curtailment, either partial or complete, of the replenishing supply of fat in the food source.

It is not to be assumed in any way that every case of pure hypercholesterolemia, in which the symptoms are referable to the disturbance of the cholesterol metabolism, should be treated by operation and relieved by the drainage of bile. Undoubtedly many of the disturbances are slight and are spontaneously corrected. Undoubtedly, too, many others can be relieved by proper dieting. Only a few will seem to be proper for surgical therapy, and, as knowledge increases, these, too, may grow less and less in number. I have in mind the method of bile drainage by the use of the intraduodenal tube; possibly for these cases the method may prove of value.

The subsequent history of this patient is that one year after discharge from the hospital she returned and was readmitted for the cure of the trigeminal neuralgia which had recurred. At this time there were no symptoms of any kind referable to the abdomen; in fact, the patient was most emphatic in her statement of the excellent result of the abdominal operation; the blood, however, showed a fairly large amount of cholesterol (0.412 milligram per cent.).

The question of how much the neuralgia was related to the hypercholesterolemia was referred to previously; it is of some importance. Neuralgias in other nerves of the body are known to be associated with other diseased condi-

tions of a somewhat similar order in which toxic bodies of one kind or another are circulating in the blood. This is the first case that has presented itself in which a neuralgia was associated with an hypercholesterolemia. It seems altogether premature, however, to express any opinion concerning the causal relation between the two until a larger experience is available.

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THE MELTZER-LYONS TEST IN THE DIAGNOSIS OF GALL-BLADDER DISEASE

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of New York, N.Y.

FROM THE SECOND SURGICAL DIVISION OF THE NEW YORK HOSPITAL

An increasing interest has been shown by the medical profession as to the value of the Meltzer-Lyons test in the diagnosis of diseases of the gall-bladder, and a series of tests were made by the Second Surgical Division, New York Hospital, under Dr. E. H. Pool's supervision.

The test is based upon the assumption that the gall-bladder is supplied by the para-sympathetic nervous system, and the sphincter of Oddi at the mouth of the common duct, by the sympathetic nervous system. Applying the facts made known by the "law of contrary innervation" Meltzer suggested that a strong solution of magnesium sulphate which would relax the sphincter of Oddi should cause simultaneous contraction of the gall-bladder with consequent expulsion of its contents.

By collecting the fluid in the duodenum after such a saline lavage, a diagnostic test for diseases of the gall-bladder based on a study of the amount, character, cytology, bacteriology, cholesterin crystals, etc., might be possible.

A knowledge of the normal physiology of the biliary system must be present before any logical conclusions can be drawn from the results of the Lyons test.

The bile contains three important and characteristic groups of compounds: the bile pigments, the bile salts, and fatty materials, particularly cholesterin. The bile pigments are products of hæmoglobin catabolism. When hæmoglobin is decomposed the hæmatin portion of the molecule is utilized by the liver cells in the formation of the bile pigment, bilirubin. After the passage of bilirubin into the intestines it is acted upon by bacteria and urobilin is formed. Part of the urobilin is excreted as such in the stools, some is taken up by the intestinal mucosa and is carried back to the liver by the portal circulation, while some may be absorbed by the general circulation and be excreted by the kidneys. The bile salts of glycocholic and taurocholic acids have much the same path. Thus, there is a continual circulation of the bile pigments and salts between the liver and intestines, aside from the cholesterin taken in the food, but little is known of its origin.

What is the place of the gall-bladder in this system? The older and less accepted views were that it was merely a "vestigial organ" or acted simply as a storehouse for bile.

Still other views held that it was an actively secreting organ, elaborating and adding something of importance to the organism. The last and most commonly accepted view holds the gall-bladder as a concentrating organ (Rous).

The gall-bladder is not absolutely essential to the well-being of the individual, as seen from the normal lives led by persons after complete cholecystectomy. However, the work of Rous disproves the theory that it is merely a vestigial organ.

Physico-chemical studies of gall-bladder bile show that nothing has been added to it except perhaps some mucin; the only change which has taken place is that the bile is much more concentrated.

The amount of normal bile secreted by an adult during twenty-four hours varies from five hundred to twelve hundred cubic centimetres. Comparing this relatively large output with the normal forty cubic centimetre capacity of the gall-bladder the impossibility of the "storehouse" or "reservoir" theory is apparent, for the gall-bladder could only contain from one to five per cent. of the twenty-four hour output.

Rous (R.-F. Institute) has definitely proven that the gall-bladder acts as a concentrating organ. The common duct of a dog is formed by the union of three large trunks, the gall-bladder emptying high up into the middle trunk. Thus a ligature appropriately placed diverts the bile from the liver into the common duct by way of the two outside trunks and into the gall-bladder by way of the middle trunk.

His analyses showed that the gall-bladder concentrates the bile received from the bile capillaries seven to eight times. The fact was also brought out that this concentrating activity is limited to the gall-bladder, the bile ducts tending to dilute the fluids they contain.

This concentration is generally conceded to be due to the rich lymphatic system which covers the surface of the gall-bladder.

The function of the gall-bladder might, then, be summarized as follows (Rous):

"The gall-bladder acts like a distensible bag interpolated into a rigid system of tubes to minimize extremes of pressure when bile comes rapidly or in large quantities from the liver, and its escape into the intestines is prevented by the sphincter. The bag in question is rendered capacious, not so much through its size as by a singular ability to reduce the bulk of fluid reaching it. The organ is also propulsive, delivering bile to the duodenum when needed. During those periods when the duodenum is empty the gall-bladder husbands the bile for future use and through its concentrating activity is enabled to retain very nearly all of the liver output when the interval from one gastric digestion to another is not unduly long."

That the gall-bladder empties itself by its own contractions has not been absolutely proven experimentally; its strongest contractions thus far having only equalled the secretory pressure of the liver. However, evidence on this point has been conflicting.

Whether the gall-bladder empties itself by syphonage, by pressure exerted upon it by neighboring organs, or by the force of its own contractions is not known. In our tests, the second portion of gall-bladder bile was separate and

distinct, as if the gall-bladder had emptied itself by its own contractions and had forced its contents into the duodenum. Hence, if these assumptions are correct, it is logical to regard the first yellowish-green alkaline fluid as the common duct or duodenal " A " bile. The more concentrated, viscid, darker second portion is regarded as coming from the gall-bladder, " B " bile. The third, watery, lemon-green fluid is regarded as coming from the hepatic ducts, " C " bile.

For the test the patient has breakfast omitted and the duodenal tube is swallowed about six inches past the stomach marking (40 cm.) and is then instructed to recline upon the right side with the hips elevated by two or three pillows. After twenty minutes the tube is swallowed to the duodenal mark (65 cm.) and the patient again reclines as before. This manœuvre is helpful because if the tube is swallowed at once to the duodenal mark it very frequently becomes knotted, whereas by the above method peristalsis takes the tube directly to the duodenum without much possibility of entangling it. Usually within one hour the tube is in the duodenum and the light yellow duodenal contents can be aspirated. The only definite way of ascertaining its position is by fluoroscopy, although the aspiration of yellowish-green alkaline fluid is usually sufficient.

After the tube is in the duodenum, about two ounces of 25 per cent. $MgSO_4$ is instilled, slight negative pressure given and the tube clamped off from three to five minutes. It is important that the fluid siphon off, as conclusions drawn from a test in which the fluid is withdrawn by repeated aspirations are frequently erroneous.

It has been repeatedly stated that the duodenum in the fasting state contains no bile. We have never found this to be the case, it may be the presence of the tube stimulates the excretion of bile. The common duct or duodenal bile has varied greatly in amount in different individuals, ranging from one-half ounce to five or six ounces. Normally it is rather clear, slightly viscid, alkaline yellow-green fluid with only a slight amount of epithelial debris and only a rare colon bacillus. No cholesterin crystals or leucocytes.

The second portion or gall-bladder bile is usually sharply differentiated from the first portion, it is more viscid, darker, often " tarry " colored and contains more bile-stained epithelial debris than the first portion. It contains no cholesterin crystals or leucocytes. An occasional colon bacillus may be seen. It is usually from one to three ounces in amount.

The third portion is usually only a few cubic centimetres in amount, is watery, lemon-green, or straw-colored. It also is negative to microscopic examination.

If one secures by siphonage the three types of bile, then one can assume that no obstruction is present.

If in a good test no gall-bladder or " B " bile is secured, then one assumes an obstruction of the cystic duct.

If the " B " bile is filled with clumps of cholesterin crystals, then a diagnosis of cholelithiasis is made. If the clumps of cholesterin crystals are scattered through both the first and second " A " and " B " biles, then there are probably stones both in the gall-bladder and common duct.

A diagnosis of cholecystitis without stones is made on the presence of abnormal amounts of bile-stained epithelial debris, abnormal number of bacteria and leucocytes. There are no cholesterin crystals present.

A pre-operative diagnosis of " mulberry stones " was made in one case on the presence of thorn-apple or ammonium biuret crystals in the " B " bile, this was verified at operation.

In a case of " strawberry gall-bladder " with the lipoid deposit in the tips of the villi and deposited in the subepithelial tissue, attention was called pre-operative to the enormous numbers of fat droplets in the " B " or gall-bladder bile.

The Lyons test was done in twenty-two cases in this series. Fourteen of these were operated upon. A diagnosis of chronic cholecystitis was made in nine (9), all of which were verified by the operator and pathologist (100 per cent.).

A diagnosis of cholelithiasis was made on the test findings in four cases, stones were found in these but also in two others. One of the cases missed contained a single stone in the wall of the gall-bladder and had no cholesterin clumps in the bile (66⅔ per cent.).

No " B " or gall-bladder bile was secured in two cases, one of these had had a previous cholecystectomy, the other was found to have a stone in the cystic duct.

Nine cases were diagnosed normal by the Lyons test. Four of these have had no return symptoms at our Follow-up Clinic. Three were tests upon medical cases with no biliary symptoms. One was on a case of pregnancy. The last test designated normal was on a middle-aged fat woman who clinically was typically a gall-stone case and was operated on for stones. A perforating gastric ulcer was found at operation; the gall-bladder, though covered with adhesions, was essentially negative.

In conclusion, we believe that although the Lyons test is not of the utmost importance in the differential diagnosis of biliary pathology, yet considerable important information may be gained from its use.

CHRONIC CHOLECYSTITIS WITHOUT STONE

By Frederic W. Bancroft, M.D.
of New York, N.Y.

Although much has been written on cholecystitis, many of us are at a loss to know in certain cases whether this is a real clinical entity. If it is, how are we to diagnose the condition, and having made the diagnosis, are we justified in performing a cholecystectomy? I refer to the type of

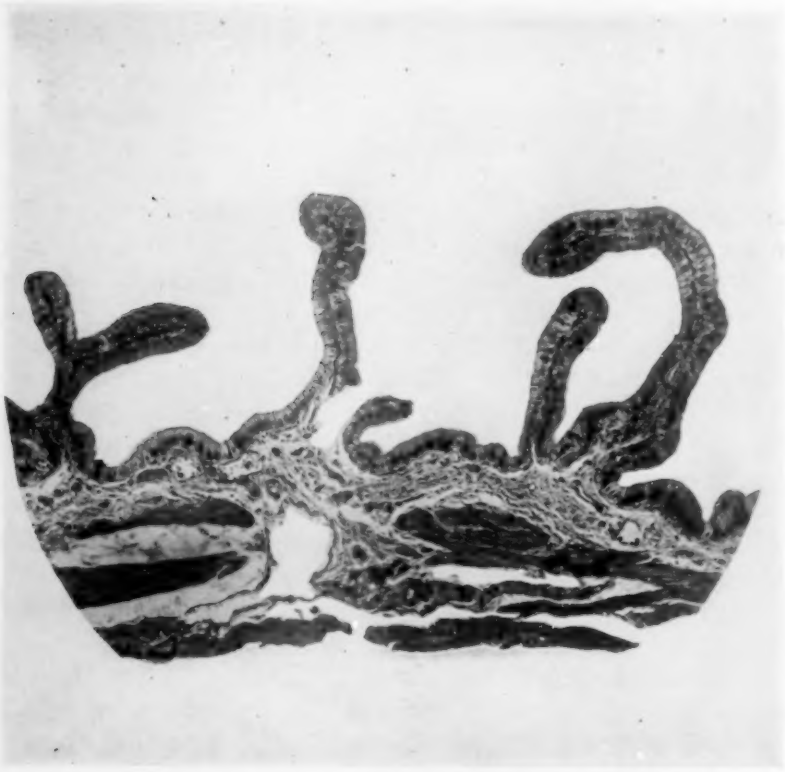

Fig. 1.—Normal gall-bladder removed at autopsy of traumatic case shortly after death. Thin stroma, narrow elongated villi; no round cells in muscularis.

case coming to the hospital with a history of repeated attacks of pain in the right upper quadrant which often radiate to the right shoulder-blade. There is often a history of vomiting and sour eructations. The attacks, however, are not as severe as those of colic due to the cystic obstruction.

Physical examination reveals as a rule a definite area of tenderness in the region of the gall-bladder. The leukocyte count is usually normal. If, at operation, the wall is definitely thickened and there are numerous adhesions

about the gall-bladder, one feels justified in performing a cholecystectomy. Frequently, however, the gall-bladder is found free from adhesions. It empties on pressure rather slowly, and the wall feels slightly thicker than normal. There may be areas of subperitoneal fat deposit as described by Deaver and Willy Meyer. If one opens the gall-bladder, it means that either a cholecystectomy or a cholecystostomy has to be performed. Is one justified, then, in opening the gall-bladder for inspection? Upon opening it, one frequently

FIG. 2.—Chronic cholecystitis, seven years duration. Gall-bladder adherent to duodenum. Contained black bile on aspiration. Granular fat seen on cystic duct. Numerous round cells in muscularis and submucosa. Cholecystectomy. Patient well.

finds the picture of a strawberry gall-bladder: small, raised, pale elevations on a red background. In other cases, the mucous membrane appears relatively normal. What procedure should one adopt in the latter type of case?

The writer feels that perhaps a careful study of a series of 38 consecutive cases may aid in the solving of this problem. Cases which have been analyzed from a study of their histories, a study of the pathological sections removed, and an analysis of late results.

Conceptions of the pathogenesis of infections of the gall-bladder are based on four assumed possibilities:

First: A descending infection from the liver by bacteria carried down in the bile.

Second: An ascending infection from the duodenum up the common bile duct and thence into the lumen of the gall-bladder.

Third: A hæmatogeneous infection of the gall-bladder and its bile ducts.

Fourth: A spreading infection to the wall of the gall-bladder through the lymphatics from an inflamed contiguous organ.

The frequency of lower abdominal infections in association with gall-

FIG. 3.—Same as Fig. 2.

bladder disease has led many surgeons to believe in the hæmatogeneous theory, but apparently there is no direct path from the appendix to the gall-bladder, for microörganisms passing up the portal vein go to the liver while the gall-bladder receives its blood supply from the cystic artery. One would assume, therefore, that the bacterial emboli would either have to pass through the liver capillaries and then reach the gall-bladder through the general circulation, or they would be transmitted through the finer bile radicals to the gall-bladder by means of the hepatic and cystic ducts.

Evarts Graham believes in the so-called hæmato-lymphatic route which was first suggested by Sudler. He has found by a series of experiments that

the interlobular lymphatics of the liver send branches over the gall-bladder. These in turn anastomose with the lymphatics which extend along the cystic and common ducts and ramify over the head of the pancreas. In cases of chronic appendicitis, Graham excised small pieces of the liver and found that there were numerous clusters of small round cells in the liver parenchyma.

FIG. 4.—First attack, although patient had suffered from indigestion for several years. Gall-bladder distended. Wall moderately thickened. On inspection, mucosa appeared normal. Mucosa intact. Numerous round cells over muscularis.

He was able also to produce experimentally in animals: hepatitis, cholecystitis and pancreatitis by injecting bacteria into the portal vein.

We have been surprised to find in the study of our cases the large percentage which had had either previous operations for inflammatory conditions of the lower abdomen or who had had a definitely diseased appendix removed at the time of operation. Our series, all from Doctor Pool's service at the New York Hospital, consists of 38 consecutive operative cases upon whom either cholecystectomy or cholecystostomy was performed. In three of the cholecystostomies, sections of the gall-bladder wall were removed for pathological examination.

Incidence.—There were 24 women, or 63.2 per cent., with an average age of 36 at time of operation. There were 14 men, or 36.8 per cent., with an average age of 36 at time of operation. The average duration of symptoms was 2½ years.

History Analysis.—The chief complaint in this series was pain and soreness in the epigastrium or right upper quadrant. The pain radiated to the back in 24, or 63.2 per cent. of the cases. In 9 of the cases it was described as

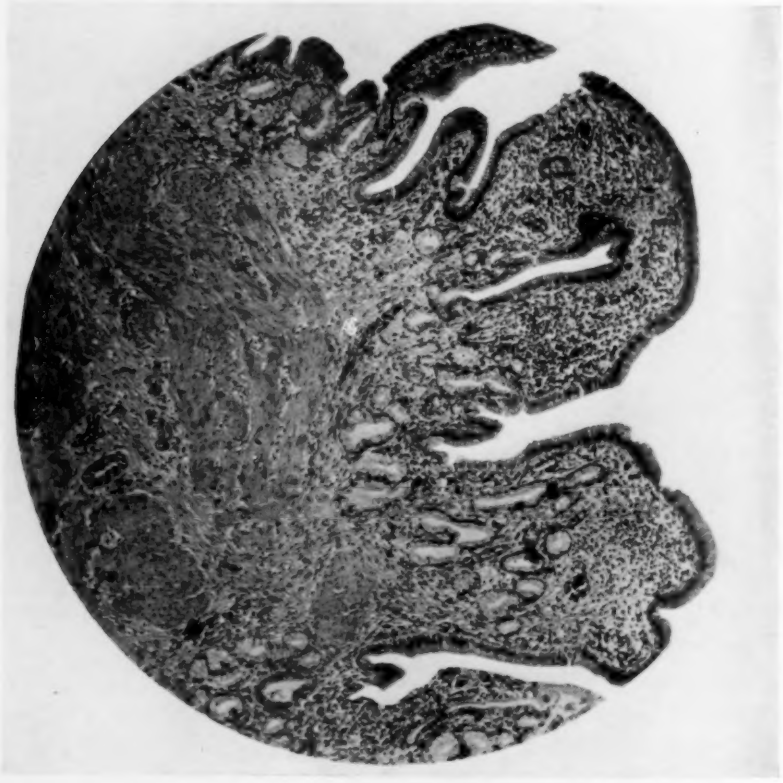

FIG. 5.—Duration, one and one-half years of pain in right upper quadrant. Wall slightly thickened. No adhesions. Numerous round cells in villi. End result good.

dull, and in 29 as knife-like. Thirteen complained of indigestion and gas after eating, symptoms which had persisted over a considerable period of time. There was vomiting during the attacks in 19 cases, or 50 per cent. Eleven women and 5 men had had previous operations for inflammatory conditions of the lower abdominal organs. In addition, 5 women and 7 men had definitely diseased appendices removed at operation. This makes the total number of patients with inflammatory conditions of the lower abdomen 28, or 73.7 per cent.

Physical Examination.—Physical examination usually revealed patients with a moderate amount of adiposity. Usually they did not appear particularly

sick. Rigidity was shown in a moderate degree in 9 cases; marked in 4; and absent in 25. Tenderness in the right upper quadrant at Murphy's point on deep pressure was noted in 35 cases and absent in 3. The ante-operative diagnosis was cholelithiasis 13 times; cholecystitis 15 times; adhesions about the duodenum 4 times; and ulcer of the stomach 2 times. In four the ante-operative diagnosis was not mentioned.

Operative Procedure.—Cholecystectomy was performed 31 times; chole-

FIG. 6.—Duration five years. Œdema of villi. Thickening of muscularis with round cell infiltration. Cholecystectomy. Poor result.

cystostomy was performed 6 times; and inversion of a distal portion of the gall-bladder in a case of hour-glass constriction, once.

The appendix was removed in 20 cases and was found to be definitely diseased in twelve of the twenty as noted by the operator. Only definitely marked lesions of the appendix have been classed in this series as diseased.

Follow-up.—Thirty-seven of the 38 cases have been examined and personally seen in our Follow-up Clinic, for periods varying from 6 to 39 months. There was no operative death in this series. There have been three subsequent operations, one a case which came back for incision and drainage of an abdominal wound abscess three weeks after leaving the hospital. One

case developed a ventral hernia, and at a subsequent operation this was repaired. One case, cholecystostomy, came back complaining of pain. An operation was done, but the adhesions were so dense that no satisfactory operative procedure could be carried out. There were 7 cases classed as poor, making a total of 81.5 per cent. good results. Subdividing the series into operations, there were: 31 cholecystectomies with 4 poor results, or a percentage of 88.5 good

FIG. 7.—Duration four months, strawberry gall-bladder. Moderate round cell infiltration. Some thickening of villi. Lipoid deposit shown with special stain. Cholecystectomy. Good result.

results. There were 6 cholecystostomies with 3 poor results, making a total percentage of 50.0 good results.

The case was classed as poor when abdominal pain and indigestion of varying degree still persisted. Five cases complained of indigestion and gas after eating. Eight patients complained of some upper abdominal pain. No history of vomiting was obtained in any of the post-operative cases. Eight cases still complained of constipation.

In analyzing the 4 poor results following cholecystectomy two cases were unimproved by operation and no satisfactory cause can be found. The other two cases were of a marked neurotic temperament. In analyzing the 3

cholecystostomy cases, one came to subsequent operation for pain in the right upper quadrant. There was such a dense mass of adhesions surrounding the gall-bladder that it was impossible to perform a cholecystectomy.

Microscopical Examination.—Sections of all the gall-bladders removed have been studied microscopically. There is great difficulty in gall-bladder surgery in determining what might be considered a normal gall-bladder.

We at first attempted to study gall-bladder removed at autopsy in patients

FIG. 8.—Eight years duration. Gall-bladder found thickened at operation. No adhesions. Mucous membrane appeared slightly reddened. Knob-like villi with some ulceration of mucous membrane. Round cell infiltration. Cholecystectomy. Good result.

dying of diseases apart from those of the alimentary tract. As a rule, however, in a general hospital service, cases do not come to autopsy until several hours have elapsed after death. During this time autolysis has occurred and sections of the gall-bladder are useless for microscopic study. Due to the kindness of Doctor Symmers of Bellevue, however, I have been able to obtain some gall-bladders from traumatic cases that were autopsied shortly after death.

Figure 1 shows very clearly a gall-bladder which may be considered normal. In it, one can see that the villi are thin with a small amount of stroma and contain long columnal epithelial cells. The submucosa contains numerous

lymphatics and areolar tissue; the muscularis is not well developed and contains numerous blood-vessels and lymphatics. There is no infiltration or clustering of round cells. In studying the sections removed at operation, we have been impressed with the fact that there are apparently two types of lesions noticed. First, cases where the mucosa and villi are relatively normal but where there is thickening of the submucosa and areas of round cell infiltration in the muscularis and submucosa. In many places the lymphatics seem

FIG. 9.—Strawberry gall-bladder, one year duration. Thickened knob-like villi with œdema and ulceration of the tips. Cholecystectomy. Good result.

distended with small round cells. In the second type, we find coarsely shaped villi often with ulceration of the tips accompanied with scar-tissue formation and round-celled infiltration. The latter type is the so-called strawberry gall-bladder and often shows lipoid deposits in the villi.

Professor William Boyd studied 100 gall-bladders removed at operation. He found that there was an ester of cholesterol formed in the mucosa of the gall-bladder. When this formation is so marked in degree that the lipoid becomes visible to the naked eye, it is usually called a strawberry gall-bladder.

He found on chemical analysis that a normal gall-bladder contained 1.70 per cent. cholesterol by weight, while the strawberry gall-bladder contained in

the region of 50 per cent. cholesterol by weight. By staining methods in microscopic study, he found cholesterol in the epithelium of the villi and in the stroma, as well as in the fibro-muscular coat. These deposits may be either inter- or extra-cellular. He believes that the club-shaped villi are due to the cholesterol deposit.

Chauffard states that small biliary calculi were found to originate inside

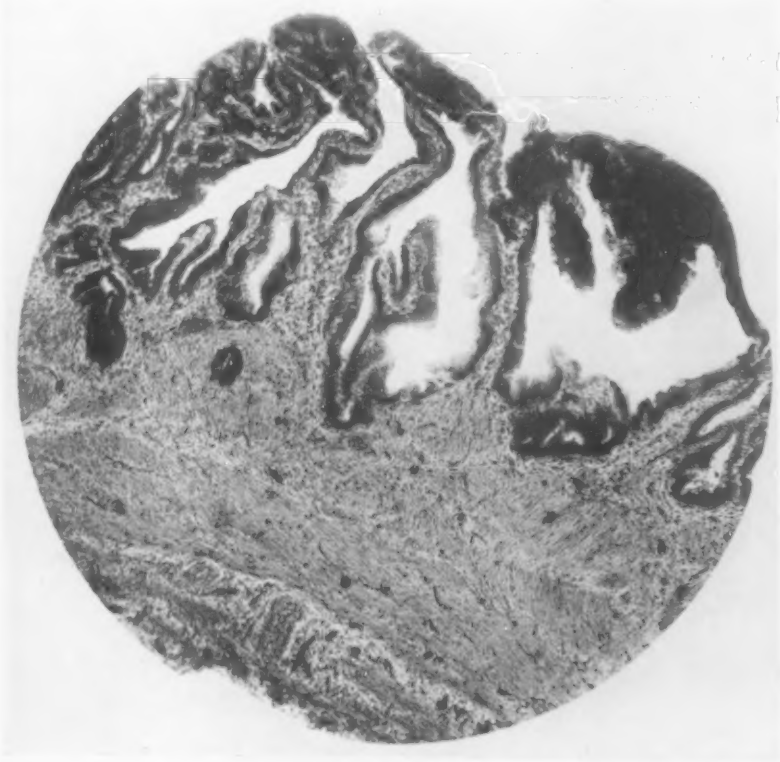

FIG. 10.—Duration, one and one-half years. Stain for lipoid deposit shows knob-like villi with lipoid deposit in mucosa and submucosa. Cholecystectomy. Good result.

the villi as minute clusters of cells surrounded by cholesterol. These are shed, then increase in size and ultimately become faceted.

From his anatomical study of the gall-bladder, Boyd believes that the delicate villi with thin-wall vessels running down through their centre can play no part as a reservoir. He believes they are constructed for absorption. In a series of experiments he injected 2 per cent. iron ammonium hydrate into the gall-bladders of dogs. These animals were killed at various periods of time from one-half hour to several hours after operation. The gall-bladder mucous membrane was washed and within one-half hour after operation numerous blue granules were seen in the epithelial cells and to a lesser extent in the stroma of the villi.

Doree fed dogs measured amounts of cholesterol and examined their

stools. He states that the amount found in the stools would only account for the amount of cholesterol in the food, and concludes from that, the bile cholesterol must be absorbed. Cholesterol is a monotonic alcohol which, on account of its solubility in fat solvents is regarded as a lipoid. Boyd summarizes his work as follows:

" First, the function of the gall-bladder is undoubtedly one of absorption,

FIG. 11.—Same case as shown in Fig. 10. Numerous round cells seen in submucosa and muscularis. Cholecystectomy. Good result.

and it is possible that one of the several substances absorbed is the cholesterol of bile. Second, the deposit of cholesterol ester in the mucosa of the gall-bladder is an important feature in early cases of cholecystitis. Third, these deposits occur in the surface epithelium, in the connective tissue and possibly in the lymphatics. Fourth, in some cases at least the first step in the development of gall-stones may consist in this formation of cholesterol deposits."

CONCLUSION

We have assumed that the cases of round-celled infiltration in the submucosa and muscularis may be due to a lymphangitis secondary to liver lesions, while the strawberry gall-bladder type may be the precursor of stone

and may be primarily due to infection through the lumen of the gall-bladder. It is possible that these two pathological types may be various stages of the same disease. But as the duration of time is practically the same in both types, it is possible that they may be separate entities.

Diagnosis.—We believe that one is justified in making a diagnosis of chronic cholecystitis when there is a history of long-standing pain in the right upper quadrant which frequently radiates to the back. This pain is usually not as severe as the colic of cystic duct obstruction. Physical examination usually reveals tenderness on pressure over the region of the gall-bladder. The Lyon test has proved a distinct aid in the nine cases in which we have used it, as the diagnosis was made in 100 per cent.

Operation.—Cholecystectomy has produced good results in 88.5 per cent., while cholecystostomy, in the smaller series in which it has been performed, has not given good results, as only 50 per cent. were cured.

DRAINAGE OF THE COMMON BILE DUCT

A NOTE ON A METHOD OF REGULATING THE EXTERNAL DRAINAGE OF BILE

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The operation of cystico-choledochostomy [1] permits an effectively closed biliary drainage system. The bile pressure following this operation can therefore be regulated in a very easy way. A reference to the drawing shows that by simply raising or lowering the drainage bottle, the pressure in the common duct can be varied. If the bottle is lower than the patient (the end of the tube being kept under water), a negative pressure can be produced in the common duct. When, however, the bottle is raised above the patient the pressure in the common duct will equal the weight of the column of bile in the tube. The normal pressure in the common duct is equal to the weight of an 8 cm. column of normal bile.

In my previous article [1] I advised clamping the drainage tube periodically on the third to sixth day after operation (depending on the pathological condition of the duct) in order to test the patency of the ampulla of Vater and to encourage the flow of bile into the duodenum. For a while, instead of clamping the tube, we connected the tube with a manometer and noted at what pressure bile ceased to drain externally. Whenever the pressure rose high enough to place too great a strain on the suture line the manometer was disconnected.

The present plan of regulating the bile pressure does away with the necessity of either clamping the tube or connecting it with a manometer. It possesses, moreover, definite advantages over both of the above mentioned methods for encouraging the bile to flow into the duodenum. For instance, the bile pressure varies; it is greatly increased when the patient coughs, sneezes or contracts his abdominal muscles. If the drainage tube be closed during a sudden rise of pressure in the common duct abnormal pressure will be brought to bear on the suture line in the duct or leakage might occur around the tube. When, however, the tube is raised above the level of the common duct to a point where the bile passes readily into the duodenum it will still act as a safety valve and allow bile to flow over into the drainage bottle when there is any sudden increase in the biliary pressure. If the bile has a free passage into the duodenum it will usually stand in the drainage tube about three or four cm. above the surface of the abdominal wall, the level of bile varying with respiratory movements. In several of our recent cases we have been able to

[1] Reid, Mont R.: Drainage of the Common Bile Duct Through the Cystic Duct; Cystico-choledochostomy. Annals of Surgery, April, 1921, p. 459.

collect the bile externally or have it flow into the duodenum, as we chose, by simply varying the level of the bottle.

There can be little doubt that a serious toxic state occasionally follows the drainage of the common bile duct of deeply jaundiced individuals. This observation has been made by many surgeons with whom I have discussed the subject.

The etiology of such toxic states resulting from a sudden release of the bile pressure is not definitely known. Perhaps the liver cells, suddenly freed from

FIG. 1.—The insert illustrates the method of placing the tube in the common duct. By varying the level of the bottle one can regulate the pressure in the common duct. At position "C" a negative pressure might be produced if the end of the tube be under a fluid in the bottle. At "A" and "B" the pressure in the common duct will be determined by the height to which the bile rises in the tube.

the long continued back-pressure of bile, assume for a time an abnormally active function and deplete the body too rapidly of substances it has become accustomed to. Or, the removal of pressure may permit the liver and possibly the interstitial cells to absorb very rapidly toxic substances stored in the liver. A somewhat analogous observation is often made in cases of general peritonitis where an evacuation of pus may be followed by a profound toxæmia and death. In these instances the sudden release of pressure seems to permit an overwhelming absorption of toxic substances.

I previously drew attention [1] to the advisability of occasionally releasing gradually the bile-pressure in the biliary apparatus, especially when the patient is deeply jaundiced. This observation has also been made by Crile [2] and others. In such cases when free drainage begins to produce a toxic state the liver can be made to function against pressure by simply raising the drainage bottle well above the level of the patient, provided the bile does not pass readily into the duodenum.

[1] Crile, George W.: The Technic of Gall-bladder Surgery in the Presence of Jaundice. Surg., Gyn. and Obst., 1921, vol. xxxiii, p. 469.

CALCAREOUS CHANGES OF THE GALL-BLADDER WALL

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Since the X-ray seems destined to play an increasingly important part in the diagnosis of cholecystitis any unusual röntgenological gall-bladder finding should be of interest.

Through the courtesy of Dr. Walter A. Calihan I was privileged to operate upon the patient whose history follows: Mrs. W., aged sixty-four years, the mother of two children, had suffered intermittently during the past three years with pain at the right costal margin. Sometimes the pain was sharp and localized; and again, a dull ache extended from this site across the chest and back between the shoulder-blades. Nausea and "biliousness" upon arising had been frequent. The appetite remained good but the tongue was often coated. Constipation had been marked for several years. Abdominal examination revealed merely tenderness over the gall-bladder region. The Wassermann test was negative. The X-ray examination by Doctor Davidson revealed a dense shadow beneath the rib margin, due, apparently, to a large gall-stone within the gall-bladder. At operation, July 31, 1922, the rounded fundus of the gall-bladder presented at the costal precisely in the location of the apparent stone shadow. Cholecystectomy was complicated by dense adhesions. The gall-bladder was somewhat larger than normal and looked and felt, both *in situ* and after removal, as though it tightly hugged a large stone. However, the pathological examination by Doctor Hastings, disclosed the true condition. It is reported as follows:

Gall-bladder 7 x 4 cm. Irregular pear-shaped, with a sharp constriction at a point one-third the length from the duct. Pale, with a hyperæmic serosa. Very hard on palpation and evidently thick-walled. A slightly enlarged lymph-node is attached to one side. The tissue around the duct is very hard and firm. On section the gall-bladder wall seems stony and the contents below the constriction are found to be semi-fluid, containing a great amount of suspended matter which is finely granular with some coarser particles. Above the constriction the contents are a solid, friable, mortar-like mass, containing stones up to 7 cm. in diameter, and adherent to the wall. All the stones are soft and some are broken. The wall is from 2 to 4 mm. in thickness. The mucosa is apparently missing throughout. Occasional minute calculi are found imbedded in the wall close to the inner surface and there is extensive interstitial calcification. Microscopic: The gall-bladder wall is thick and made up almost entirely of extremely hyaline connective tissue. The mucosa is missing and there is a dense polymorphonuclear and endothelial-cell infiltration of the inner surface of the wall. A few calcified areas are found in the section. (A non-calcareous area was chosen for section.)

Osler observed that calcification of the gall-bladder commonly follows suppurative cholecystitis. There are two separate forms: incrustation of the mucosa with lime salts and the true infiltration of the wall with lime, the so-called ossification. Carman gives an illustration of the incrustation type and the gall-bladder herein described exemplifies the interstitial change.

Kaufmann, in discussing these lime deposits, states that as a result of chronic catarrhal inflammation, sometimes without stones, "the thick,

calloused, often entirely smooth wall can calcify (even ossify) and acquires thereby the appearance of an arteriosclerotic vessel wall." Kaufmann further observes that when calculi are present "in case the stones escape from the gall-bladder and an ulcerated inner surface remains, the lumen can disappear completely with adhesion of the ulcerated walls; the gall-bladder can transform itself into a bean sized, solid, fibrous, not rarely calcified structure." Sternberg notes that as a result of long continued chronic inflammation "the gall-bladder often becomes smaller and can, as a consequence of suppurative processes, shrink into a scarcely cherry-stone sized, dense, fibrous, nor rarely also calcified body, enclosed in pseudomembrane, over which the edge of the liver appears notched. The lumen is in such cases fully preserved, obliterated, or still recognizable as a mere slit, in which are to be found thickened, chalky, mortar-like or calcified masses. In case the gall-bladder contains concretions these are firmly embedded on all sides in fibrous tissue."

FIG. 1.—Röntgenogram showing dense shadow, due apparently to a large gall-stone within the gall-bladder.

Regarding frequency most röntgenologists agree that calcareous changes of the gall-bladder wall are rare. Pfahler, for example, says, "I have never to my knowledge found any calcareous deposits in the gall-bladder wall. It cannot be frequent, for I make a gall-bladder study in every gastro-intestinal study and have done so for years." Crane states that he has no case on record of calcareous deposits in the gall-bladder wall. And Pancoast observes that he does not recall any case in which such deposits had been found. George in his atlas gives no illustration of calcareous changes in the gall-bladder wall. And Roberts merely hints at the possibility of a similar condition in the state-

ment regarding stones revealed by the X-ray that " Had the friable bilirubin calcium stones found at operation been in the form of sand they would have outlined the gall-bladder."

Cole, on the other hand, writes that " calcareous deposits in the wall of the gall-bladder in cases where the organ contains debris and thickened, inspissated bile, is not an uncommon occurrence, but I do not recollect having observed calcifications of the wall of a gall-bladder containing approximately normal bile."

Roberts, in a personal communication, notes that he has observed calcareous deposits in the gall-bladder wall but only on a few occasions. Roberts can conceive of no way in which such deposits could, with any certainty, be differentiated from calculi lying free within the gall-bladder.

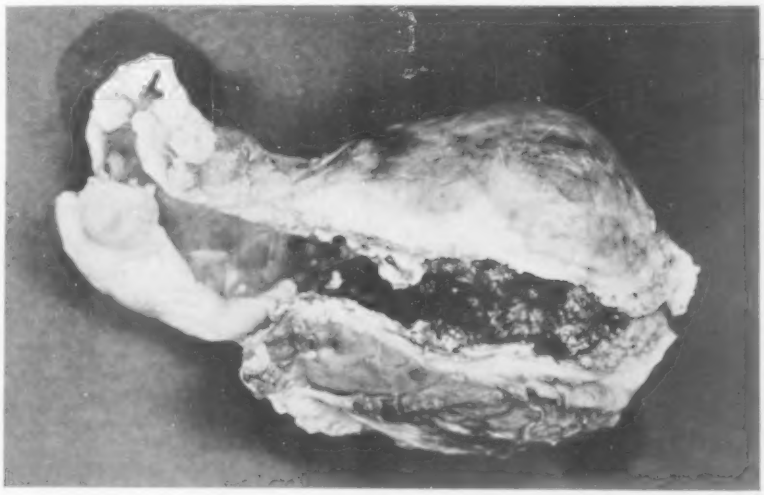

FIG. 2.—Excised gall-bladder showing thickness of the calcareous wall and the mortar-like mass within the organ.

Stewart " would not venture to say that we have ever been able to distinguish calcareous deposits in the wall of the gall-bladder from ordinary gall-stones. I have had one or two cases that showed large stones and then some smaller deposits which I felt were incrustations in the mucous membrane. Certainly, I have never been able to make a diagnosis of calcareous masses in the wall." George writes, " We have seen calcification in the gall-bladder wall occasionally though we never recognized the fact that it was definite calcification of the wall rather than stones until after the operation. In one or two instances we have found shadows which were not typical of gall-stones, and which proved to be calcification of the wall, so that the surgeon would have to scrape off the calcified material with a curette or spoon. In other instances we found impacted bile. I don't know as it makes a great deal of difference whether these areas are attached to the wall, in the wall, or free in the gall-bladder. It represents pathology and, of course, that is our first endeavor. I do think,

now that this matter has been called to our attention, as it has been previously and now by your letter, that we keep this possibility in mind and at least be able to say that we suspect it in some cases by the appearance of it."

The rarity of the ossified gall-bladder from the pathologist's viewpoint is indicated by the fact that Reimann finds no record of a gall-bladder with generalized calcareous deposits in the wall.

Finally, a survey of the literature reveals few reports, from any source, regarding the calcareous gall-bladder.

Summary.—A woman who had borne two children exhibited the syndrome of cholecystitis during three years. The X-ray examination disclosed a dense shadow due, apparently, to a sizeable gall-stone. At operation and afterwards the gall-bladder looked and felt as though it contained a large calculus. However, incision of the organ and microscopical examination revealed generalized lime deposits within the gall-bladder wall.

Ossification of the gall-bladder follows chronic, usually suppurative cholecystitis. This calcification is rarely encountered by the röntgenologist, the surgeon or the pathologist. The röntgenological differentiation between a large stone within the gall-bladder, loose sand outlining the organ, or incrustations upon or interstitial deposits within the gall-bladder wall is difficult if not impossible. In the interest of accuracy, however, the appearance of the shadow might sometimes suggest calcification of the gall-bladder wall.

The writer expresses his indebtedness to Drs. S. C. Davidson and Willard S. Hastings, for their coöperation in the preparation of this paper.

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ANEURISM OF THE RENAL ARTERY

AN ANALYSIS OF ALL CASES IN THE LITERATURE WITH A REPORT OF A CASE AND A DISSERTATION ON THE ETIOLOGY, PATHOLOGY, SYMPTOMS, DIAGNOSIS, PROGNOSIS, AND TREATMENT OF THIS CONDITION

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In the performance of an autopsy recently on an elderly woman, a pathological curiosity whose existence was totally unsuspected during life was unearthed, an aneurism of the renal artery. Because of the rarity of the condition and the significance that it can sometimes be to both surgeon and patient, it seemed worth while to ferret out such scattered scraps on the subject as the past has bequeathed us, and by an analysis of them to try to derive something that may be of value.

The first published description of a case came from the pen of Daniel Nebel and is to be found in the Academia Cæsareæ Leopoldino Carolinæ Naturæ Curiosorum Ephemerides, Centuria IX and X. This aneurism was disclosed in the year 1717 in the person of a medical man. Since then, 30 other cases have been published, the last one in 1919 by Orth, so that the present case report will bring the entire number of published cases up to 32. The incidence of this condition is, therefore, very small, and a cursory glance through the literature on aneurisms in general would leave one with the impression that, when compared with those of other vessels in the body, aneurism of the renal artery is one of the rarest types, if not the rarest, known to occur. Oestreich was of this opinion and there are a few published statistics bearing on this point. Thus, in 6,425 autopsies done at the Pathological Institute of Jena, Müller found 171 aneurisms, of which only three were located on the renal artery. Bosdorff at the Institute of Kiel found 93 aneurisms in 3,108 sections, not one of them being renal. And Emmerich discovered but one renal aneurism in 58 aneurisms of all types occurring in 8,669 sections. With these statistics as a basis, the occurrence of renal among aneurisms in general as met with at autopsy is 1.2 per cent.

Since more or less complete collections of the hitherto published cases have been previously made by Ziegler, Morris, Keen, Skillern, Trulli, and Vogeler, it will serve no purpose here to repeat work already well done and available for reference. So, a complete resumé is omitted, a report of only my own case being set down in detail. In order, however, to furnish a check upon the accuracy of the construction of the appended clinical picture of renal aneurism, in which direct reference is made—in enumerating the types of aneurism, symptoms, signs, etc.—to individual cases, some sort of tabulation of them is necessary for purposes of reference. The following table is, therefore,

constructed, the cases with two exceptions being numbered in chronological order. The name given is that of the author who published the case and the date is the time of publication. The division into "traumatic" and "spontaneous" is utilized to separate the aneurisms due to trauma from those in which no traumatic history could be elicited. A specimen in the Museum of St. Bartholomew's Hospital (Catalogue, vol. 1, 1882, No. 1536) is not included in this number because an account of it has never been published. Morris described it as a small aneurism of a renal artery, the wall of the sac, as well as the adjacent part of the artery being thick and calcareous. Nor, in spite of the convincing clinical picture presented, is a case recently published by Vogeler included, for the diagnosis was not confirmed by either operation or autopsy.

Traumatic

1. 1717. Nebel (referred to later by Titius).
2. 1770. Rouppe.
3. —— Rayer (case of Danyau's).
4. 1849. Mounier.
5. 1884. Reeves (also reported by Turner).
6. 1900. Murray (reported by Morris).
7. 1868. Hilton.
8. 1891. Hochenegg.
9. 1891. Gruber.
10. 1891. Oestreich.
11. 1894. Hahn.
12. 1900. Morris.
13. 1900. Abbott.
14. 1906. Skillern.
15. 1916. (?) Penkert (from Trulli).
16. 1916. Kaunitz.
17. 1919. Orth.

Spontaneous

18. 1803. Dourlin.
19. 1829. Gossett.
20. 1852. Leudet.
21. 1856. Danner.
22. 1885. Armstrong.
23. 1891. Oestreich.
24. 1900. Barnard.
25. 1900. Keen.
26. 1904. Higgins (also reported by Fulton).
27. 1906. Engel.
28. 1909. Markley.
29. 1916. Trulli.
30. 1916. Trulli.
31. 1917. Key and Akerlund.

The following case of renal aneurism, the thirty-second to be reported, falls into the spontaneous group.

32. Through the courtesy of Dr. F. L. Smalley of Reading, Mass., I performed an autopsy on the body of a patient who had been under his care, Mrs. M. G., aged seventy-two years. She had had dysentery at the age of forty-five, followed by bronchitis of several years' duration, and pneumonia at the age of fifty-six. There had also been several mild "rheumatic attacks" accompanied by pains in both shoulders, elbows, knees and ankles, but nothing further to indicate that these were attacks of true rheumatic fever. Ever since her recovery from pneumonia, she had been troubled by slight dyspnœa, and the ankles had swollen a little off and on, but only after she had been on her feet a great deal. Although the menses had ceased at the age of fifty-six, there had been a slight vaginal discharge, sometimes blood tinged, occurring about once a month from the time when she was sixty-two years of age, until her death, but no special attention was paid to this. Her fatal illness had its onset in April, 1920, when the left nipple became infected, along with the gradual development of a bluish nodule under the skin of the breast. During the following year, the patient lost ten pounds in weight. One year later, in April, 1921, she was referred

to the Massachusetts General Hospital for treatment. Examination at this time showed a nodule in the left breast, with slight retraction of the nipple, and a bluish discoloration of the skin over the tumor. There was no glandular involvement. The peripheral arteries were thickened and tortuous, the heart slightly enlarged, and the blood-pressure was 200/100. There was slight œdema of the lower extremities with varices of both internal saphenous systems. A pelvic examination was not made. Shortly after admission a radical breast amputation was done and histological examination of the removed tissue showed carcinoma, with, however, no lymph-node involvement. Recovery was uneventful, and the patient was discharged to her local physician. While under his care, she gradually lost somewhat in weight, and developed sharp pains in the right shoulder and arm, these being set down to metastatic deposits in the cervical region of the cord. The patient continued to lose weight and towards the end had to be catheterized. Death occurred on February 10, 1923, some thirty-four months after the appearance of the breast tumor.

The autopsy was performed three and one-half hours after death and the following anatomical diagnosis will indicate the findings.

Anatomical Diagnosis.—Primary: A. Senility; scar of old radical breast amputation; metastatic carcinoma in the 8th and 9th dorsal vertebræ, adjoining ribs, and right humerus (primary in breast); emaciation; decubitus ulcer.

B. Generalized arteriosclerosis involving chiefly the coronary, splenic, and renal arteries; chronic interstitial nephritis; hypertrophy of left ventricle.

Subsidiary. Keratinizing adenocarcinoma of uterus; adenoma of kidney; *saccular aneurism if inferior branch of right renal artery;* encapsulated apical pulmonary tuberculosis; fibrosis of lower lobe of left lung; fibrous perisplenitis and perihepatitis; interacinar fibrosis of pancreas with slight hyalinization of insular tissue; acute purulent and necrotizing cystitis; varices of saphenous vein tributaries; œdema of lower extremities; multiple cutaneous pigmented moles.

For the sake of brevity, a detailed orderly description of the viscera is omitted, but there are several interesting features of the case that deserve a little elaboration. In the first place, the patient had four distinct types of tumors, two of them malignant—the mammary and the uterine—and two benign, the adenoma of the kidney and the cutaneous moles. The uterine growth, which is a rather uncommon type, presented as a reddish-gray globular mass filling and distending the upper half of the uterine cavity. Histologically, it was composed of epithelial cells having an adenomatous arrangement, often with papillary infoldings and abrupt transitions from glandular structure to pearl formation—a type of growth which Ewing designates an adeno-acanthoma and which is, in his opinion, relatively nonmalignant. Further, this case raises anew the question of the vagaries of the distribution of arteriosclerosis. Here, it is the coronaries, splenic, and finer radicals of the renal arteries which are hardest hit, the former only in their larger divisions, the latter just the reverse.

But the most interesting feature, perhaps, from a pathological standpoint is an aneurism of an inferior branch of the right renal artery. When first palpated, this was thought to be a calculus within the renal pelvis for it was small, round, and of stony hardness. After removal, and careful inspection of the kidney, it is found to be a small aneurism in direct continuity with a branch of the renal artery, situated just distal to the origin of three branches of this vessel which run to the upper pole of the kidney, and having its origin from the superior of two inferior branches into which the main artery divides. It is covered by a very adherent, thin, fibrous capsule, which, when removed, leaves a smooth, yellow, oval tumor, 12 x 6 x 8 mm. in size and in consistency, so calcareous, that it is difficult to section. When sectioned, it does not collapse and in its cavity, which is

smooth-walled, there is but a drop or two of liquid blood. At its point of communication with the artery, the sac is 6 x 8 mm. in size. The wall varies from 1–3 mm. in thickness, the latter dimension being greatest at the latero-inferior portion. Histologically, it is composed of dense hyaline tissue, in which a great deal of calcific material and fat has been deposited. The wall is in direct continuity with that of the artery, but sections of it treated with an elastic tissue stain, show complete absence of elastic fibres in it.

As would be expected, this aneurism gave rise to no symptoms during life and was of no clinical significance. Both clinically and pathologically it is similar to the cases reported by Key and Akerlund, Leudet, Danner and Abbott, except that the latter's may have been traumatic in etiology. But it might well have became of vital importance if the patient should have sustained a trauma to the right side, for pathologically, it is practically a duplicate of the specimen uncovered by Barnard, which, when wedged against the liver by external violence, was so hard in consistency that it tore the liver and resulted in a fatal hemorrhage.

Etiology.—In the etiology of renal aneurism, of first importance is trauma, 17 of the 36 cases, or 56 per cent., having been due to this cause. Of the 17 cases, all gave a history of injury to the side, back or abdomen, and in 8 of the 15 cases in which a cause was definitely stated, ten were due to falls of various sorts, thus, fall from a horse (2 cases), fall downstairs (2 cases), fall from tree, fall athwart a gunwale, fall from ladder, fall on side, fall on back, fall from cart. In the remaining five, the following causes were operative: stab wound of abdomen, gunshot wound of abdomen, struck side against a counter, knocked down and run over by hand cart, struck by engine. Of the 15 cases in which no history of trauma could be elicited, 6 or 40 per cent., were associated with generalized arteriosclerosis which had involved the renal arteries in all but one case. And 9 cases, or 60 per cent., had occurred in patients who had had severe infections which either were of long duration, or had antedated the patient's death by a long period of time. Thus, three patients had had pneumonia; two endocarditis; two chronic nephritis; two malaria; one rheumatic fever; one lues; and one had pleurisy with effusion shortly before death, in some instances more than one of these affections having occurred in a single patient, as the figures imply. The possibility of antecedent infection is, therefore, probably of some significance in relation to aneurism formation. It appears to be of more importance in this series than arteriosclerosis, although, in view of the possibility of the latter affection being due in a large percentage of cases to infection, it seems superfluous to argue here for or against the relative importance of one or the other factor to aneurism formation.

Age Incidence.—Of the 17 cases of traumatic origin, no age was mentioned in three, *viz.*: 1, 2, and 16, the first of these having been referred to as a "medical man"; the second, as a "young boatman"; and the third was a soldier in active service and, therefore, neither very old or very young. But of the 14 remaining cases, the youngest was 15 and the oldest 56 years of age, with a general average for this group of 36 years. In only one of the 15 spontaneous cases was the age not given, Case 23, and here the patient was referred to as a "young man." Of the remaining 14 the youngest represent-

ative was 9 and the oldest, 82 years of age, with a general average of 56 years for this group. The average age incidence for all cases of both types in which an age was given is 46 years. So there is no characteristic age period at which renal aneurism occurs, the relatively greater frequency of cases of spontaneous origin in middle and advanced life being probably more apparent than real due to the fact that this type produces no symptoms, as a rule, and is only an

FIG. 1.—Small saccular aneurism of renal artery, located just distal to the origin of three branches going to the upper pole and on the upper wall of the superior of two inferior branches, into which the renal artery divides. The cut on the anterior surface of the kidney hemisects a small adenoma.

incidental finding at autopsy, which may have existed in the body for many years.

Pathology. Type.—From a pathological standpoint, renal aneurisms fall into the same two main divisions as aneurisms of other vessels, *viz.:* false, in which the sac is formed of surrounding tissues which have walled off the blood extravasated from the ruptured vessel; and true, in which the wall of the sac is formed of arterial walls, one of which at least is unbroken. So there is much more uniformity in structure of the wall of the sac in the latter type than in the former. Thus, as a rule the false aneurisms were large sacs containing blood and blood clot, situated in the region of the kidney and covered anteriorily by peritoneum which in some instances was densely adherent to the underlying sac. The latter, in some instances, was very large (Nos. 3, 4, 11, 18) and partly or completely filled one side of the abdomen, with resultant displacement of the abdominal viscera. In three instances

(Nos. 2, 4, 18), the sac in its anterior was a large multilocular structure filled with blood and blood clot mixed with urine, with complete or nearly complete destruction of the kidney. In regard to those cases in which there was a large sac either adjacent to or surrounding the kidney, it is difficult, as both Morris and Vogeler affirm, to determine whether or not the renal capsule was fused to the wall of the sac with the extravasated blood within it, or whether the

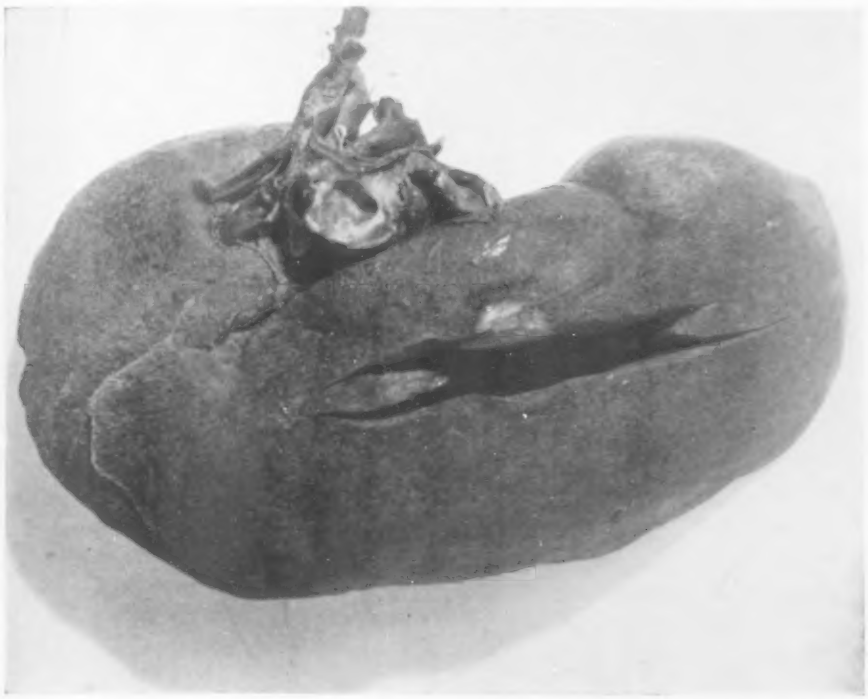

FIG. 2.—A cross section of the renal aneurism. Showing its communication with the artery, its sacciform structure, and its thick calcific wall.

latter was located external to the renal capsule and was delimited solely by neighboring tissues, usually the retroperitoneal tissue. In Cases 2, 5, 8, 11, and 25, it is very probable that the kidney capsule was actually a part of the sac wall, while in Cases 7, 12, 14, and 17 this point is impossible to determine with any degree of certainty. The majority of the false aneurisms, of which there are 18 in all, were produced by trauma, fifteen of this type having been due to this cause, the remaining three (Nos. 18, 22, 25) having occurred in the absence of traumatic history. Of the remaining 14 cases, thirteen are examples of true aneurism, eleven of which occurred without and two (Nos. 13, 16) with a history of antecedent trauma. The remaining case (No. 23) does not admit of proper classification because of the incomplete report given.

Size.—The majority of the false aneurisms are large, while in the case of the true aneurisms, the reverse is true. Thus, of the 18 cases in former group, in the 11 instances in which the size was fairly definitely stated, the dimensions

of the smallest (No. 8) were 15 x 10 cm., and of the largest (No. 4), 25 x 20 cm., and the latter weighed 3,490 grams. Many of them were described as "large," "the size or a child's head," "the size of an adult head," "filling the left abdomen." The true aneurisms, on the other hand, were small, of the 12 cases in which the size was definitely stated, the smallest was described as being "the size of a marrow-fat pea" and the largest as big as an orange. Five were reported as having been as large as a hazlenut. These aneurisms were usually hard in consistency due to a calcific deposit in their walls, and in some instances were, at first, mistaken for a renal calculus (Nos. 24, 31, 32).

Location.—Because of the large size of the sac, its adherence to surrounding structures, and the destruction of the kidney usually associated with it, it was impossible to determine the exact point of origin of some of the false aneurisms (Nos. 1, 3, 4, 8, 10). Five (Nos. 6, 9, 12, 17, 18) apparently arose from the main trunk of the renal artery; two (Nos. 15, 25) from one of its main branches; two (Nos. 2, 11), from branches located within the capsule; three (Nos. 5, 7, 14), from tears in smaller vessels in the renal parenchyma incidental to laceration of the kidney, itself; and one (No. 22), from an interlobular artery. Of the 13 true aneurisms, two (Nos. 9, 26) were located on the main trunk of the artery; three (Nos. 21, 28, 31), at its bifurcation; and the remaining eight (Nos. 13, 16, 20, 24, 27, 29, 30, 32), on one of its various branches.

Sequelæ.—Renal aneurism may give rise to several pathological consequences, chief of which, in the order of their importance are: (1) rupture into the renal pelvis, usually with resulting exsanguination via the urinary tract; (2) rupture into the peritoneal cavity; and (3) destruction of the neighboring kidney. In all, there are 13 instances of the former complication, two (Nos. 19, 27) associated with true and eleven with false aneurisms. In the latter group, the communication between sac and renal pelvis was definitely stated to have been traced in but four instances (Nos. 3, 4, 7, 10), but it seems fair to assume that in the seven additional instances in which a history of hæmaturia was given such a communication must have existed. There are but two instances (Nos. 1, 7) of rupture into the peritoneal cavity, and in both cases it was a false aneurism which had ruptured. Destruction of the kidney, partial or complete was quite a striking concomitant feature of the false aneurisms. In two instances (Nos. 3, 18) the destruction of the organ was complete, and it had entirely disappeared; in Case 4 it was converted into a large multilocular sac with but little bits of kidney substance in the various septa; in seven cases (Nos. 1, 5, 7, 8, 10, 12, 15) it was partially necrotic; in four instances (Nos. 11, 14, 17, 25), atrophic; and in three cases the condition of the organ was not mentioned at all. The true aneurisms, on the contrary, apparently resulted in but little damage to the kidney *per se*. No mention was made as to its condition in many cases. In Case 16 it was partially necrotic and in Case 21, atrophied.

Symptoms.—An attempt to search out and group into a composite clinical picture the symptoms and signs of renal aneurism unfortunately can not be based upon the history of the entire 32 cases, for in four instances (Nos. 6, 16, 22, 23) the history is entirely lacking and in three others (Nos. 1, 15, 26) it is very meagre. But the latter three cases will be utilized in so far as they go, thus bringing the total number available for analysis up to twenty-eight. Of these, in six (Nos. 13, 20, 21, 24, 29, 32) there were no symptoms or findings directly referable to the presence of aneurism, and indeed, this is no more than one would expect, for they were all very small true aneurisms, perfectly intact and spontaneous in their origin. The remaining 22 cases, however, presented definite symptoms and signs.

Pain and Hæmaturia.—The combination of abdominal pain followed within a short period of time by the passage of bloody urine is the most characteristic feature about the onset of the illness. This symptom complex occurred in 15 or 54 per cent. of the 28 cases in which a history was obtained (Nos. 2, 3, 4, 5, 7, 8, 9, 10, 12, 14, 17, 19, 25, 27, 30). Pain in itself is of little significance, for in 14 of the 19 cases in which it occurred (Nos. 1, 2, 4, 5, 7, 8, 9, 10, 12, 14, 15, 17, 18, 19, 25, 26, 27, 28, 30), it was associated with trauma or a sudden strain and might, therefore, have been due to an injury to intra-abdominal structures other than the renal artery and kidney. In other words, abdominal pain following immediately upon the receipt of an injury could not, in itself, justifiably lead to a suspicion of renal aneurism. In two instances (Nos. 9, 27), the passage of blood in the urine followed immediately after the onset of pain; in 9 cases (Nos. 2, 3, 7, 8, 10, 12, 14, 17, 30), within 24 hours; and in three cases (Nos. 4, 5, 19), within a week. Needless to say, the time relationship of the appearance of the hæmaturia to receipt of injury or strain was, in most instances, the same as it was to the onset of pain. In six cases (Nos. 2, 5, 10, 25, 27, 30) the hæmaturia appeared but once, and in three of these (Nos. 5, 10, 27), led to death by exsanguination within two weeks. In the nine others, the bleeding appeared on more than one occasion, the greatest number of recurrences having occurred in Case 8, in which the hæmaturia disappeared, only to reappear eight times over a period of twenty months; the shortest interval of freedom having been one month, and the longest, six months, the bleeding lasting as a rule 3 to 7 days in each exacerbation. This tendency of the hemorrhage to cease and recur is fairly characteristic, there being 9 instances of more than one attack (Nos. 3, 4, 7, 8, 9, 12, 14, 17, 19), each attack persisting over periods of time varying from a few days (No. 9) to three weeks (No. 4), with periods of freedom between attacks ranging from a few days (No. 9) to four and one-half years (No. 12). The quantity of blood lost during each attack was difficult to estimate because it was, as a rule, mixed with urine. Perhaps the least quantity lost was in Case 25, where the urine contained only a little blood on one occasion. In Case 3, 3 to 4 "palettes" of blood were passed at one time; in Case 27, the urine was filled with blood; and in four instances (Nos. 3, 7, 9, 19), clots were

passed. There are 11 cases (Nos. 3, 4, 5, 7, 8, 9, 10, 14, 17, 19, 27) in which the hæmaturia was profuse enough to exsanguinate the patient.

Minor Symptoms.—While pain and hæmaturia dominate the symptom complex of renal aneurism, there are a few symptoms of subsidiary importance brought out by some of the cases. Thus, six of the patients (Nos. 3, 4, 7, 9, 18, 19) complained of dysuria and three of them had to be catheterized. It seems reasonable to explain this on the basis of small clots having plugged the urethral orifice with resultant distention of the bladder. In addition, as would be expected, several of the patients, after repeated hemorrhage, complained of weakness and pallor and showed signs of collapse. Two of the patients (Nos. 1, 17) felt a throbbing in one side of the abdomen and one (No. 11) after having fallen downstairs, experienced the sensation of "a ball moving around in the abdomen" and actually palpated the tumor, herself.

Signs. Tumors.—On physical examination, the most constant and reliable finding is tumor. This was found by the clinician in 16 or 57 per cent. of the 28 cases with recorded histories (Nos. 3, 4, 5, 7, 8, 9, 10, 11, 12, 14, 17, 18, 22, 25, 28, 30) in contrast to the occurrence of hæmaturia in 54 per cent. of the same cases. While hæmaturia is, therefore, the most valuable symptom at our disposal for diagnosis, tumor is the most valuable sign, and of these sole two findings, tumor is, as indicated, a little the more reliable and constant and is, therefore, the most important single factor in the diagnosis of renal aneurism. Nor do the above figures properly convey its true importance, for in five additional cases (Nos. 1, 2, 6, 23, 26) it seems, from the size of the tumor met with at autopsy—in every case at least as large as an orange—that it could have been palpated during life and been an aid to diagnosis, if looked for. The tumor as encountered at the bedside usually occupied one of the upper quadrants of the abdomen and varied widely in its limits. The smallest palpated (No. 30) occupied the left flank and was described as being as large as an orange. The largest one encountered (No. 4) resulted in a bulging forward of the entire left abdomen and extended from high up under the diaphragm well down into the iliac fossa and for a considerable distance to the right beyond the midline. And between these extremes, all intermediary gradations in size were met with.

As a rule, the tumor was smooth in outline, firm in consistency, fixed in position, and did not move with respiration. In only one case (No. 11) was ballottement obtained on bimanual abdominal examination, and in only one other (No. 8) did the mass shift with change in posture. Usually, the percussion note over it was dull and neither bruit or pulsation could be detected in it, with the exception of Case 1 in which pulsation was distinct: Case 8 where it was indistinct; and Case 12 in which a systolic bruit was audible. This is explained by the fact that such a large layer of blood and blood clot intervene between the inner pulsatile portion of the tumefaction and its capsule that the relatively small excursions of the renal artery where it enters the sac are

deadened and prevented from being transmitted to the outer portions of the aneurismal sac.

The tumor was not tender on palpation except in Cases 3, 5, 8, 19, 31.

As would be expected, it can make its appearance with great rapidity following injury. Thus, in Hahn's case (No. 11) the patient fell downstairs, and upon arising noted a feeling as though a "ball were moving around in the abdomen" and she actually felt the tumor, herself, which the clinician reckoned to be the size of a child's hand. In some instances, the growth of the tumor remained stationary for a time—apparently due to organization of the clot in the ruptured vessel, only with a subsequent yielding of the clot after a slight trauma or strain or even in the absence of any apparent cause whatsoever, to take on renewed growth. This occurred after the following quiescent intervals: 9 days (No. 2); 49 days (No. 3); 2 months (No. 10); 6 months (No. 17); 8 months (No. 9). The significance of these facts was borne out by the post-mortem findings of sacs filled with both old laminated clot and fresh soft clot (Nos. 2, 3, 17).

Diagnosis.—Clinically, there is but one condition which a small renal aneurism might be confounded with and that is renal calculus. Indeed, in one instance (No. 31) the kidney was actually removed for calculus when a small aneurism was really present. In this case the history of hæmaturia and slight pain and tenderness in the loin, coupled with the X-ray finding of a small spherical shadow in the hilic region had led to the diagnosis of calculus. In a given instance, the differentiation might be difficult, but the sudden onset of severe pain, its sudden cessation, the presence of red corpuscles in the urine, and the recurrence of attacks would all point to calculus, for Case 31 was the only one of all the small aneurisms, in which hæmaturia and pain were present, and even in this instance, the hæmaturia was an observation on the part of the patient which examination of the urine failed to confirm, and the pain was very slight.

The large aneurisms, however, may offer a real problem in diagnosis, for they may simulate the clinical picture presented by (1) hydronephrosis, (2) renal neoplasm, and (3) ruptured kidney.

In the case of hydronephrosis, there is usually no history of antecedent injury and the hæmaturia is generally absent, or, if present, slight, while in aneurism, the reverse is true. Further, the hydronephrotic sac is elastic in contrast to the solid consistency of the aneurismal sac. The size of the former is also subject to marked variations in size due to alternating periods of retention and sudden passage of large amounts of urine, while in aneurism, this feature is lacking.

Renal neoplasm may be in a given case very difficult to diagnose from aneurism. The tendency of the hæmaturia to be preceded by a sudden abdominal pain and to disappear and recur, rather than to be constantly present; the sudden, in contrast to the gradual onset of weakness and anæmia; the absence of cachexia; and the lack of tenderness over the tumor, all point to the presence

of aneurism in contradistinction to neoplasm. Further, the finding of metastatic deposits in other parts of the body would strongly prejudice one in favor of the latter condition.

As for ruptured kidney versus renal aneurism, it seems futile to attempt to differentiate them clinically, for nothing short of exploratory operation can settle the question. And after all, the differentiation is more of academic than practical importance. In both instances, there is a hæmatoma surrounding the kidney, and if the blood composing it had its origin in ruptured vessels within the kidney other than arteries, it is designated simply as hæmatoma, while if the source of the hemorrhage was an artery, the resultant extravasation is classified as false aneurism.

Prognosis.—Renal aneurism which produces symptoms is fatal in 100 per cent. of cases unless operation is resorted to, for in the 24 cases in which the symptoms complained of were referable to the aneurism, only the six who were operated on survived—the remaining eighteen having died of this condition. In some instances, a fatal outcome followed rapidly upon the onset of symptoms—thus in Cases 24 and 26, within two days. Usually there were several attacks of pain and hæmaturia over a period of several weeks or months, death finally having occurred from a large hemorrhage into the renal pelvis, retroperitoneal tissues, or peritoneal cavity. The greatest interval of time between the onset of symptoms and lethal exitus was 5 years (No. 12). The average duration of the illness, as based on 14 fatal cases in which this point could be determined was 283 days, and in all but three of these (Nos. 1, 9, 12) the total duration was 4 months or less.

Treatment.—For those aneurisms which give rise to symptoms, there is but one efficient type of treatment, as the outcome of 24 cases illustrates. All of these died except those six which had been operated (Nos. 8, 11, 14, 17, 25, 31), and in two instances (Nos. 12, 15) operation failed to avert the catastrophe. So, the mortality with operation is 33 per cent. In view of the 100 per cent. mortality if no radical measures are undertaken, surgical interference has, therefore, proved itself justifiable. The best procedure is apparently removal of the sac together with the kidney. This was successfully done by Hochenegg, Hahn, Deaver, Key and Akerlund and Keen. In the other successfully operated case (No. 17), Orth removed the contents of the sac and sutured the tear in the renal artery, and the kidney one year later was functioning pretty well. But this procedure should not be advocated, in fact Morris was inclined to decry it. The latter advocates an oblique lumbar incision at the start, and an extraperitoneal approach is made until the nature of the tumor is discovered. This can be done by nicking the sac, and if laminated clot is found further penetration of the sac should be desisted in for fear of starting a profuse hemorrhage. Once the growth is determined to be an aneurism, if small, the peritoneum is reflected medially and the sac together with kidney is removed extra-peritoneally. If the sac is large, a transperitoneal approach should be made by continuing the incision anteriorly. The

renal pedicle should be clamped before attempts are made to free the sac from surrounding structures. When this has been accomplished, the renal vessels and ureter are ligated, the pedicle severed distal to the ligatures and tumor and kidney removed in toto.

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THE TECHNIC OF RENAL AND URETERAL SURGERY*

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It has been fifteen years since the surgery of the kidney and ureter was selected as a subject for discussion by this Association and ten years since a paper dealing with operative technic has been presented. I propose briefly therefore to review some of the points in the operative technic of renal and ureteral surgery, based largely on personal experience and observation.

Kidney Exposure.—I think nothing in the way of improvement in exposure of the kidney has been presented in recent years. Personally I have found the suggestion of Wm. J. Mayo, namely, an incision beginning over the twelfth rib and dividing the arcuate ligament and the quadratus lumborum to be a valuable one. Since using this incision I have but once, and then without harm, injured the pleura, and have never found it necessary to resect the twelfth rib.

I am convinced that the abdominal route is preferable to the posterior route in many cases where one is sure that nephrectomy is necessary, as in large tumors, and where other abdominal lesions are present, and in certain cases of wound of the kidney and possible associated wound of the abdominal viscera. It is much easier to remove large kidney tumors by this route and to do the operation with less likelihood of disseminating the growth by breaking into it or by manipulation. If drainage of the kidney region is necessary after this method of approach, the drain can be carried out posteriorly through a stab wound and the field easily excluded by peritoneal suture.

However, one should not allow the fact that he has made an abdominal incision for the exposure of the kidney to influence him to do a nephrectomy for a kidney lesion which does not require it.

Exposure of Both Kidneys.—In 1906 (Jour. A. M. A., vol. xlvii, p. 2047) Leonard Freeman published a paper advising the exposure of both kidneys in certain cases of tuberculosis, and I should like to commend this method when, for any reason, doubt exists as to which kidney is involved or as to the involvement of both kidneys. Of course one will have recourse to this procedure much less frequently now than formerly, owing to the improvement in diagnostic methods.

The following two cases illustrate the value of the method. In 1907, at the Pennsylvania Hospital, I had foolishly done a suprapubic cystotomy in a case of tuberculosis of the bladder. The bladder was so extensively involved that ureteral catheterization of the ureters could not be done either before or after the cystotomy. We suspected the right kidney was the source of the trouble, but were not certain, nor were we able to know that both were not involved. The

* Read before the American Surgical Association, May 31, 1923.

right was first exposed and found to be extensively diseased; the left was then exposed and found to be normal; the right was removed. The double exposure added but fifteen minutes to the time of operation. Following the nephrectomy the suprapubic wound closed and the patient, a physician, made a rapid convalescence and has continued the practice of medicine ever since (sixteen years). In 1909, I operated upon him for tuberculosis of the costal cartilages. The wound healed promptly and he has developed no further tuberculous lesion.

In June, 1913, I operated upon Dr. W. for tuberculous epididymitis, one testicle having previously been removed for tuberculosis. While he was in the hospital he had an attack of renal pain on the right side and passed blood. I was sure that he had tuberculosis of the right kidney and wanted to operate upon him, but he went home and I did not see him again until January, 1914, seven months afterwards, when he came to Philadelphia with a discharging suprapubic fistula. He had developed a tuberculosis of the bladder and a suprapubic cystotomy had been done for retention of urine. Repeated attempts by expert urologists to catheterize the ureters, even under general anæsthesia, were futile. I was sure the patient had tuberculosis of the right kidney, but I was unable to be sure the left kidney was not also involved. The left kidney was first exposed and found to be normal in every respect, except for a small fluctuating superficial mass. I thought this might be a hæmatoma, due to traumatism in delivery, though this had been easy. The area was incised and a creamy pus escaped from a small superficial pocket which did not communicate with the pelvis or a calyx. The interior was wiped out with carbolic acid and closed by suture. The right kidney was then exposed, found to be extensively diseased and removed. The suprapubic wound healed and the physician returned against advice to his practice. He died a few weeks ago from tuberculosis of the left kidney and bladder, but had continued to practice for nine years after his operation. The interesting point in this case was that, had we been able to catheterize the ureters, we would have believed the left kidney to be free from disease, nothing would have been done to it and the patient probably would not have regained his health, even for a few months. William J. Mayo's method of exclusion of the infected ureter after nephrectomy by threading it into a tube, which is brought out at the lower angle of the wound, would seem to be a good one.

FIG. 1.—K. M., Pennsylvania Hospital, No. 197, 1922. This plate represents phosphatic stones, filling the pelves and extending up into the calyces in such a manner as to give the appearance of a pyelogram and has been often so interpreted. Stones removed from right kidney by Doctor Billings, July, 1922. Stones removed from left kidney, March, 1922, through pyelotomy and from incisions through kidney substance. A handful of stones were removed. No sutures. Discharged March 31st. Death occurred two weeks after she returned home.

Incisions for Removal of Kidney Stones.—Fifteen years ago in this Association a good deal of difference of opinion was expressed regarding the method of exposure and removal of stones from the kidney pelvis, the calyces and the kidney substance, but I think to-day there would be a pretty general endorsement of the views expressed at that time in a paper by Bevan, who urged pyelotomy and direct incision over the stone, should it lie in a calyx or in the parenchyma. The accurate localization of stones by the X-rays

certainly removes one of the reasons advanced for longitudinal section of the kidney. The multiplicity of stones or the large size of a stone in my experience does not call for the section of the kidney. I will show an X-ray slide of a case in which I removed sixty stones through two incisions in the kidney substance, and I have repeatedly removed enormous stones, which filled the pelvis and extended into the calyces, by carrying the pelvic incision up into the kidney substance, and am sure that this incision does much less harm, is accompanied by less hemorrhage and is followed by prompter healing than section of the kidney. Eisendrath has recently (Surg., Gyn. and Ob., May, 1923) described this incision and called it "Enlarged Pyelotomy." If it is necessary to carry the incision into the kidney substance, the retro-pelvic artery can be ligated before division. An interesting article on "Renal Function following Nephrotomy," by Magoun (Surg., Gyn. and Ob., May, 1923) gives ample proof, from a study of a series of cases at the Mayo Clinic, that complete section of the kidney is a far more dangerous procedure, both from the point of hemorrhage and subsequent function, than pyelotomy, or pyelotomy and several small incisions through the kidney substance.

FIG. 2.—F. D., Pennsylvania Hospital, No. 334, 1921. Large stone removed in three pieces through pelvic incision. One suture. No record of urinary leakage. Discharged on fourteenth day.

I have no cause to change my opinion on this subject as expressed in a paper before this Association in 1913, and since that time have not once resorted to complete section of the kidney for the removal of stones. Where the parenchyma of the kidney is incised directly over the stone, the incision should extend in a line from the periphery of the kidney toward the centre of the pelvis and should be closed by mattress sutures.

One of the surprising things about pyelotomy and multiple incisions is the absence or short duration of urinary leakage. This leakage, I am sure, depends more on the way the opening is made than on the way it is closed. Figure 5 shows a large stone extending into a calyx. It was removed through an incision extending up into the kidney substance. No sutures were placed in the pelvic wound and yet there was only a small leakage of urine for two or three days. The incision should be made large enough for the removal of the stone and not enlarged by tearing. No forceps should be applied to the edges of the cut pelvis for retraction or for the control of hemorrhage. A clean incision heals readily while a ragged one, or one with traumatized edges, does not. I have made some very imperfect closures of the pelvic wound in which there was no leakage of urine. I am sure that in the past our gauze drains were responsible for the urinary leak. Even when a cigarette drain is used the exposed gauze at the end should not come in contact with the incision. Nearly any closed wound in a hollow viscus will leak if

gauze is placed against it. In kidney and ureteral surgery soft rubber drains should be used and lightly fixed, where wanted, with a small plain catgut suture, so that they can be easily withdrawn.

I believe that incision in the pelvis and multiple small incisions through the kidney substance are not themselves ever the cause of a fatality. We know that section of the kidney, even when no lesion is found, carries with it a definite mortality.

Bilateral Stones.—The presence of stones in both kidneys, in both ureters and in one kidney and the other ureter presents a problem which it is not easy to solve.

In our last discussion of this subject, Watson, of Boston, seemed to show that the simultaneous operation on both sides was safer than operating on one side and then on the other. The factor that will go furthest in deciding this important question is the function of the two kidneys. If renal elimination is poor on both sides and urea retention high, any operation is very risky. If elimination is normal, either method is practicable; but even here we will meet with occasional anuria after removal of stones from one side, and such a development calls for prompt operation on the other side. In looking over my records I find it has been my custom in these cases to operate first on the side where the function is poorer and then on the other side. The situation and the size of the stones should not influence us too much, though, as a rule, where there is a renal stone on one side and ureteral stone on the other, the ureteral stone should be made to pass or be removed before doing anything to the kidney stone. One of the slides I show illustrates this point; although there was a very large stone in the right kidney, causing a great deal of pain and fever, with a large quantity of pus, the function of this kidney was better than that of the left, the ureter of which was partially obstructed by a stone which was causing no symptoms. The ureteral stone was removed and twenty-one days later the stone in the right kidney was removed through a pelvic incision carried up into the kidney substance for a short distance. The kidney wound was sutured but no sutures were put in the pelvic wound. Urinary leakage from the ureteral wound was only of two or three days' duration and from the right kidney for about the same period.

FIG. 3.—N. C., Pennsylvania Hospital, No. 407, 1921. Large ureteral stone removed March 16, 1921, by combined intra- and extra-peritoneal ureterotomy. Peritoneum accidentally opened but opening utilized to fix stone and ureter during removal. No sutures, urinary leakage for about a week. Phlebitis only post-operative complication.

Fluoroscopical localization of stones on the operating table has been perfected by Braasch and Carman (Jour. A. M. A., 1919, vol. lxxiii), and

in certain cases it must prove of inestimable value, as we have all been embarrassed by being unable to find a stone which has been apparent in a plate, or by being unable to assure ourselves that all stones, or all particles of a stone, have been removed. I have not as yet used this method of localization.

Nephrectomy.—Nephrectomy for stone is rarely necessary and should never be done unless we are quite sure the kidney is hopelessly damaged by infection or hopelessly injured by manipulation. Recently, for the first time, I was obliged to do a nephrectomy for a single stone because of injury I had done the kidney in delivery. It was in a second operation for stone, and the adhesions were very thick and dense. The nephrectomy was done because of bleeding.

One reason for being conservative in regard to the removal of the kidney is the fact that stones are very apt to be present or to develop in the other kidney. Braasch found bilateral stones in one out of six cases of renal stone at the Mayo Clinic. Another justification for conservation of the kidney is that it is difficult to prognosticate the future function of the kidney by a consideration of its condition at the time of the operation. One case which I had will illustrate these points very well.

FIG. 4.—N. C., Pennsylvania Hospital, No. 449, 1921. Sixty stones removed, March 14, 1921, by pyelotomy and two incisions made directly over stones. No sutures in pelvic wound. No leakage of urine. A year previous these stones were thought to be gall stones and a negative exploration of the gall-bladder made by another surgeon, who found the stones to be in the kidney but did not remove them. On removal these stones were faceted and in shape and color were exactly like gall stones.

I first operated upon Mrs. J., fourteen years ago (1906). She had an enormously distended and infected right kidney, due to a large stone in the lower ureter. It seemed as if all secreting substance had been destroyed, except a little good kidney structure at the upper pole. The kidney was drained and the ureteral stone removed by the combined intra- and extra-peritoneal method. Patient made a good recovery and there was no leakage from the ureter, which was not sutured. The kidney condition certainly might have justified a nephrectomy.

Four years later (1913) I operated upon this patient for a strangulated femoral hernia. Eleven years after the first operation (1920) I again operated upon her for a large stone filling the pelvis of the left kidney and extending up into the calyces. The kidney was badly infected and distended with foul pus and urine. The stone was removed in many pieces through a pelvic incision. Nephrectomy seemed indicated here but we had been unable to catheterize the ureters and did not know the function of the right kidney. The urinary output after this operation was normal and the patient made a good recovery.

Eighteen months after this operation (1921) I operated upon Mrs. J. again for acute infection of the gall-passages with jaundice due to stones: a cholecystectomy was done and patient recovered without any kidney or other complications, although there was a fair-sized stone in the lower pole of the left kidney at the time, evidently the result of leaving a small piece of stone at the last operation.

In May, 1922, I once more operated because of symptoms of intestinal obstruc-

tion, due to adhesions, and again she made a good recovery. This poor woman's life may not have been a happy one during the past fourteen years, but I think it illustrates the wisdom of avoiding nephrectomy in some cases where it would seem to be indicated.

Removal of Stones from Lower Ureter.—Strides have been made in removal of stones from the ureter since our last discussion of this subject. The non-operative method, the dislodgement of the stone with the ureteral catheter, resulting later in its passage, has removed from the field of operative surgery about one-half the cases of ureteral stone and represents a great advance in treatment. The size of the stones sometimes made to pass by this method is quite surprising. But the remarkable success obtained does not mean that this method is always indicated or that even its trial is always justified. If attempted in cases not suitable for it, it may do harm and will in any such case put the patient through an unnecessary amount of discomfort. Braasch (Mayo Clinic, vol. xi, 1919, p. 267) says that when a stone has been lodged in the lower ureter from three to six months, or is more than 2 cm. in diameter, the possibility of dislodgement with the catheter is greatly diminished. Where there is a serious infection of the ureter or kidney, I think the method should not be used. However, in the majority of cases, if the stone is not too large and the evidence of infection slight, several attempts should be made to dislodge the stone. If these attempts are followed by much reaction they should be discontinued and the stone removed by operation. If the stone is not too large to pass and its arrest in the lower ureter of short duration, neither dislodgement nor operation should be done, but a reasonable chance given it to pass. The drinking of large quantities of water will undoubtedly facilitate its passage.

FIG. 5.—S. D., Pennsylvania Hospital, No. 752, 1923. Ureteral stone removed by extraperitoneal ureterotomy April 3, 1923. No sutures, some drainage but urinary leakage questionable. Kidney stone removed by enlarged pyelotomy April 24, 1923. No sutures. Discharge had urinary odor for three days, requiring change but once a day.

In endeavoring to decide between dislodgement with the catheter and operation, one of the factors to be considered is experience. I would prefer the operation in experienced hands rather than dislodgement by an inexperienced cystoscopist, and the dislodgement by a good cystoscopist than operation by a surgeon without experience in this field. It may then very readily become a question of the man and not the method.

The mortality of the operation of removing stones from the ureter is practically nil. Judd (ANNALS OF SURGERY, 1920, vol. lxxi) reports 400 such operations from the Mayo Clinic with but one death. I have personally removed stones from the ureter in 22 cases with no deaths and the most

serious post-operative complication was a phlebitis. In none of these was there obstinate urinary leakage or infection. In the majority there was no leakage of urine and in others it lasted from two to ten days. The end results have been, I believe, remarkably good, though I have not been able to follow up all my cases. The technic of this operation has always interested me and I have presented to this Association and elsewhere several communications on the subject (ANNALS OF SURGERY, May, 1906. Surg., Gyn. and Ob., May, 1908, and ANNALS OF SURGERY, August, 1913).

The earlier routes for the removal of stones in the lower ureter, the vaginal and sacral, I think have been very properly abandoned, and I doubt whether even the vaginal route is ever justified, because it has been followed by more and longer urinary leakage than any other.

FIG. 6.—M. T., Pennsylvania Hospital, No. 1476, 1923. Two large facetted stones removed May 15, 1923, by pyelotomy. Pelvis sutured. Urinary odor on dressings for three days only.

The most satisfactory incisions are a muscle-splitting one above and parallel to Poupart's ligament and the rectus sheath incision (Gibson's incision). When the peritoneum is reached it is reflected towards the pelvis until the iliac vessels and the pelvic wall below them are well exposed. The ureter adheres to the peritoneum and is reflected with it, making it sometimes difficult to identify and grasp. Its location can often be made out by palpating the stone, and if not it is most easily identified at the point where it crosses the iliac vessels. I have always located the stone with the finger before mobilizing or opening the ureter, and if this is not readily done I make a button-hole in the peritoneum, pass one or two fingers through it, locate the stone and push it up with the ureter until it can be seen or readily felt in the extra-peritoneal wound, where, without removing the finger which supports the stone, from the peritoneum, the ureter is incised and the stone removed. A gauze sponge is placed immediately over the wound in the ureter to take up any escaping urine and the ureter then closed with sutures, or a rubber-covered drain is fixed near the incised ureter without suturing. The finger in the peritoneum is now withdrawn and the button-hole closed.

Extensive mobilization of the ureter, I think, is a mistake and apt to delay healing. It can be avoided by using one or two fingers on the peritoneal side for support of the ureter in difficult cases. I have opened the peritoneum in about one-half my cases, but never do so if I can easily find and remove the stone without doing it. In no case has the stone ever been removed through the peritoneum and in no case has there been a peritoneal infection. I am sure the combined intra- and extra-peritoneal operation cuts down the time of the operation enormously in difficult cases. Twice in women where the stone was very low in the ureter, an assistant's finger in the vagina has been of great help in bringing the stone up into view in the extra-peritoneal wound.

A dilated ureter makes its identification much easier and greatly facilitates the removal of the stone. In these cases I think it is often better to open the ureter a little above the stone and remove it with the Mayo common-duct forceps. If the stone can be pushed up to a higher point in the ureter without too much traumatism, it is better to do so, and to remove it through an incision at this point. In nearly all my recent cases I have put no sutures in the ureteral wound, many of which have healed without leakage and none of which have had any more leakage than in the cases where the wound was closed. The ureter should not be so displaced or twisted that the incision is made in its floor. The reason why leakage has been so troublesome when stones were removed through the vagina is probably because the incision is made in the floor of the ureter.

FIG. 7.—M. M., Jefferson Hospital, B-5242, 1912. Large stone, upper third of kidney normal, lower two-thirds destroyed. Sac containing stone drained after closing its communication with the pelvis. Late urinary leakage for a week.

Everything that has been said about incisions, sutures and drainage in pyelotomy applies equally to the ureter.

In closing I should like to urge the advantages of the combined intra- and extra-peritoneal operation for stones in the lower ureter, where the stone is not easily found and removed through the extra-peritoneal wound. In my own experience it has made many difficult operations comparatively easy and has saved the ureter much unnecessary traumatism.

In order to rectify the misapprehension which has appeared in some text-books, I should like to say that I have never advocated the removal of stones through the peritoneum and have never removed one by this route.

A CONSERVATIVE TREATMENT OF CARBUNCLES*

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The *usual* treatment of carbuncles as carried out at the Presbyterian Hospital during the past few years has been operative. Crucial incision to the limits of induration, with flap undermining, has been the most commonly employed procedure, with an occasional treatment by excision. These methods, while very effective in the majority of cases, are far from ideal because of their radical nature.

In reviewing the literature on carbuncles, I found many different conservative methods of treatment had been employed in isolated instances. Phillips [1] states that most carbuncles will heal up without operation, and advises the avoidance of operation unless there are special indications demanding it. Dennis [2] reports a case successfully treated by zinc ionization. Anderson [3] used high frequency current on one case with excellent result. Picton [4] gives the following prescription: "Paint them around with a ring of collodion. Paint them again each day, and each day encroach with your collodion ring more and more on the red surrounding areola. You will find that that is all that is necessary. They will get well." McIlhenny [5] and also Dikshit [6] advocate the use of Bier's vacuum hyperæmia, and each reports two or three cases, Dodds [7] reports a desperately sick patient with carbuncle of the face cured by administration of autogeneous vaccine. Walters, Coombe and Solly [8] report recovery of a patient with carbuncle of the face, Ludwig's angina, and parotitis, following the use of autogenous vaccine, and citric acid given by mouth. Frick [9] states that X-ray and leucodescent light seem failures, and passive hyperæmia has not proven efficient. He concludes that vaccine treatment is the best method, and incision second best.

Three references were found to the use of X-ray, in addition to Frick's passing mention, given above. Coyle [10] used it on three cases, of moderate size. The pain disappeared almost immediately, and they healed very rapidly without breaking down or discharging. Dunham [11] claims the successful treatment of sixty-seven consecutive cases of carbuncle. No protocols are given. His results: complete change in clinical picture within forty-eight hours. The first night after, the patient is more restless and sometimes believes the treatment has done him harm. The second night he sleeps well, the infected area ceases to be painful and the infected part can be moved without distress. From that time on, the principal object of treatment is to prevent reinfection. Sometimes the induration is gradually absorbed with little or no discharge. At other times it breaks down and discharges through numerous sinuses. But usually a large carbuncle will soften up and take on the appear-

* Abstract of cases omitted because of lack of space.

ance of an abscess. In such cases it is a simple matter to lance it and permit free drainage. Almost no scar results from this treatment.

Ross [12] describes one case of severe carbuncle of the face and neck cured by use of X-ray.

I was impressed by the favorable, though few, reports of the use of X-ray. I received further encouragement to try this method from Dr. James A.

FIG. 1.—Case XVI. Twenty-two days after X-ray. Illustrating result on moderate sized carbuncles. Carbuncle 9x5 cm. at time of admission.

Corscaden, whose office I share, and who has had several successful cases of carbuncle treated by X-ray. He very kindly placed his machine at my disposal, and has given me most valuable suggestions and advice in the management of the sixteen cases I am here reporting.

The general plan of management of these cases has been as follows. First the administration of a two-thirds erythematous dose of X-ray, when first seen, or as soon as a diagnosis of carbuncle could be made. The following formula was employed: 90 kilovolts; anode skin distance 25 cm.; filter 1 cm. of wood, 6 mm. Bakelite, 1 mm. aluminum, 4 mm. leather; current 4½ miliamperes. With this formula the erythematous dose is about 60 milampere minutes. In each of the cases here reported a dose of 40 miliampere minutes was given.

Immediately following the X-ray treatment, a dry dressing was applied, and the patient was asked to use flaxseed poultices at frequent intervals. Many of these patients, however, were so situated that poulticing could not be and was not done. The wound was dressed daily, and surgical indications carried out, such as removal of slough through existing sinuses, the enlarging by phenol of existing sinuses, or the drilling of new small sinuses by the tooth-

FIG. 2.—Case X. Illustrating course of large carbuncles under X-ray treatment. Four days after X-ray. Size 15x7 cm. Localizing and softening.

pick dipped in pure carbolic acid method, irrigations with Dakin's solution; later, strapping with flamed adhesive to promote epithelization, etc. Before and following the X-ray, only dry dressings were used, and great care was taken to avoid the use of irritants about the wound for fear of a resulting skin burn, as cautioned against by MacKee and Andrews.[13]

This series of sixteen cases was unselected, and consecutive except for two patients, not included, who expressed desire for incision, and upon whom I therefore operated. All the patients of the series showed multiple foci as manifested by numerous discharging sinuses. As it happened, only one, number 13, showed glycosuria, and this appeared only in one examination in his case. Stay in the hospital was indicated for only three patients in addition

to the two operated upon. Case number 9, because of high fever, toxæmia, and pain was admitted immediately, and remained three weeks. Case number 10 was admitted after ten days of treatment, when the process was well under control, largely because of homeless and destitute condition. He remained 19 days and benefited greatly from irrigations with Dakin's solution t.i.d. Case number 12 was admitted to a hospital 11 days after treatment,

FIG. 3.—Same as Fig. 2, six days later and 10 days after X-ray. Completely broken down and undermined, draining freely through multiple sinuses.

because of persistent pain, in order to have Dakin's irrigations t.i.d. to hasten the separation of a very deep seated slough. He remained 3 days in the hospital. Many of the patients carried on their work normally, only interrupting long enough to come in for dressing.

Only two of the series received operative treatment. The first was patient number 6, who came before we had sufficiently demonstrated the efficacy of the treatment to make us feel justified in carrying the patient through in the face of old age, temperature, toxæmia, and albumenuria, even though the carbuncle was reacting well following the X-ray, and had not increased in diameter. He was therefore operated upon on the second day following X-ray, a crucial incision with flap undermining being done. He made a long slow recovery,

which was apparently not hastened by the X-ray. Had this patient come later in our series, I feel sure that he would not have received operative treatment at the time he did, for we subsequently treated larger and more serious carbuncles successfully by X-ray alone, cases number 9 and 10.

The second patient to be operated upon was number 14. He had a very deep-seated board-like, and sluggish process, which had not softened appre-

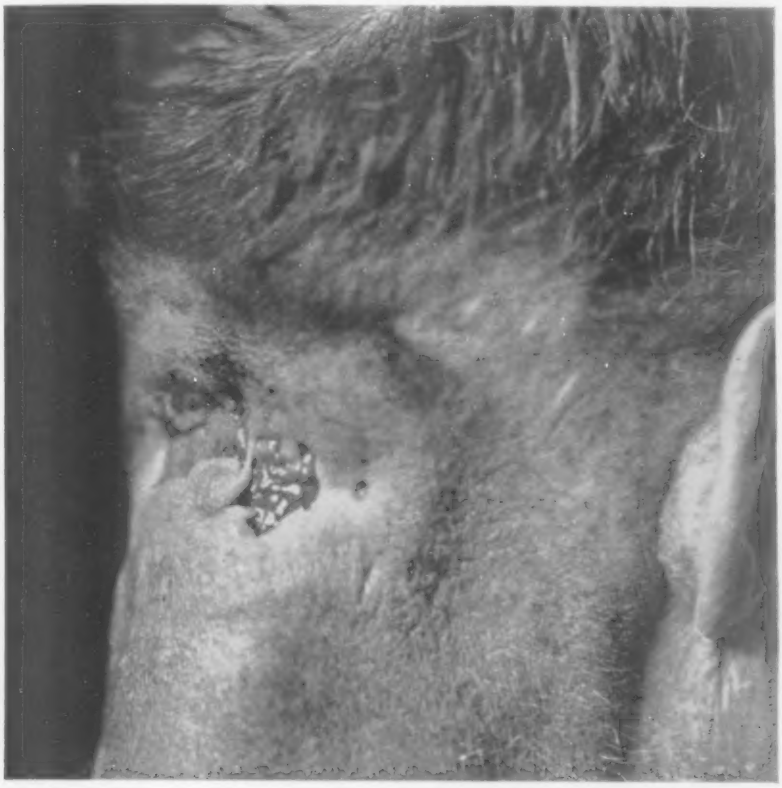

FIG. 4.—Same as Fig. 3, twelve days later and twenty-two days after X-ray. Clean, granulating, beginning to epithelize.

ciably by the tenth day after X-ray. Though the spread was scarcely more than the usual, and though his condition was not unsatisfactory, operation to hasten softening and establish drainage was clearly indicated. Crucial incision with undermining was therefore done on the eleventh day after X-ray. For 5 days following this procedure there was no appreciable softening, then a very protracted convalescence and healing occurred.

The behavior of these cases after X-ray was as follows: Redness, local swelling without increase in diameters, and elevation above surrounding tissues were distinctly increased in most of them 24 and 48 hours after X-ray. The diameters of the induration were increased in half the cases between the second and fifth day after treatment. In only two cases was this increase more

than 2 cm. in any diameter, and in many it was less. In the most severe case of the series, number 9, the only one where the spread caused any anxiety, the carbuncle had spread from 11.5 x 6.5 cm. to 13 x 9 cm. on the fifth day; and then, instead of stopping as did the others, it continued spreading, in one direction only, another 3 cm., until the measurements were 16x 9 cm. on the

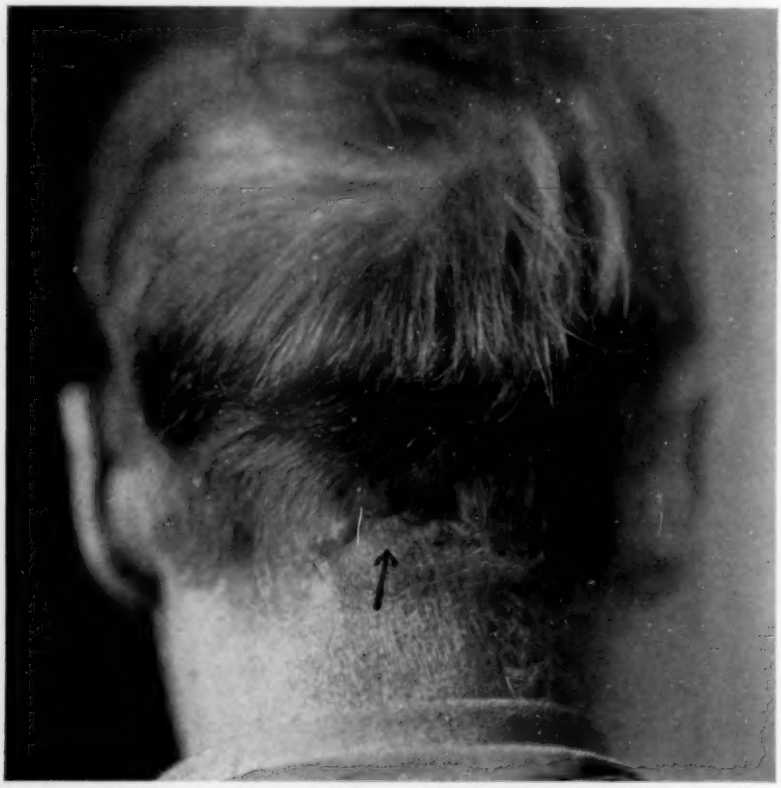

FIG. 5.—Same as Fig. 4. End result of Case X. Taken at follow-up, three and one-half months after X-ray.

eighth day. I think the probable explanation of this was the too narrow protecting in this case of the field of the X-rays in giving the treatment.

Suppuration and sloughing in the small and moderate sized carbuncles was surprisingly small in amount, and this took place through correspondingly small sinuses. This disproportion between, on the one hand, the size of the carbuncle, and, on the other, the amount of slough and size of the sinus is strikingly illustrated by case number 13. On the tenth day, when the induration was 8x6 cm., a slough 1 cm. in diameter was discharged through a sinus of the same dimensions, after which healing was rapid.

The duration of the sloughing process in the small and moderate sized carbuncles was short. Ten of this series could be considered under this classification according to size. With eight of these the sloughing was completed

within a week. In detail: Five had completed their sloughing by the fourth day; 2 by the fifth; one by the seventh; one by the tenth; and the 10th case, a very deep seated carbuncle, not until the fourteenth day.

The duration of the stage of granulation and epithelization in carbuncles of this size was usually short, because of the small size of the cavities left by sloughing and suppuration, and because of the slight destruction of epithelium in the formation of a sinus.

The very large carbuncles, illustrated by cases 9 and 10, resolved into enormous, sharply demarcated abscesses, a single cavity without demonstrable dividing septa. This occurred in 4 days in one case; and in the other, except at the point of spread referred to above, in 7 days. They then drained, with appropriate treatment, through sinuses formed by sloughing of the overlying skin, and went on to healing by granulation and epithelization.

Pain is the most important subjective symptom in cases of carbuncle. Relief from pain was experienced by the majority of this series of patients following the X-ray treatment. With four of the sixteen pain was not a symptom. Five complained of slight pain before treatment, and had no pain after. Three had had severe pain and had been unable to sleep. They reported that their pain was only slight following the X-ray, and that they had slept well. One had slight pain which persisted after treatment. One had had very severe pain before administration of the X-ray, but for 24 hours succeeding the treatment he had complete relief. His pain then recurred, and was very troublesome intermittently until satisfactory drainage of the carbuncle was established. In the case of only two was no relief from pain obtained, and their pain persisted until free drainage was secured.

With regard to the total duration of the process, I was unable to make comparison with similar cases treated by operation, since accurate measurements of operated cases were not given, and the number of my own cases was too small. Insofar, however, as I was able to form an impression, it is my belief that the small and moderate sized carbuncles heal in a much shorter time with X-ray therapy than following operation; and that large carbuncles consume about the same amount of time with either form of treatment. But this is not of great value, as it is only an impression. Figure 6 gives the duration of my cases.

The cosmetic results of this form of treatment afford the greatest contrast with incision. Excluding the two cases operated upon, the end results of eleven out of the remaining fourteen are known, as regards scarring. Six out of these eleven, at time of discharge or at follow-up showed scars less than 1 cm. in diameter. Photographs of two of these are shown as examples (Figs. 1 and 7). Follow-ups were obtained on four out of the remaining five of this eleven. A photograph is shown of the largest of these cases, Fig. 5. The other three appeared as follows: One, seen 3 months after treatment, measures 4 x 1.5 cm.; the second, 11 months after X-ray, 2 x 1.5 cm.; the third, 10 months after treatment, 3.5 x 2 cm. All three of these scars were smooth, soft,

not depressed, movable over the underlying tissues, and only distinguishable from the surrounding skin by their pallor, their epithelium containing less pigment than the surrounding skin. All of these cases compare most favorably with the commonly observed results of operation, and with my two cases

FIG. 6.

Case number	Max. size.	Completely healed, after X-ray.	Notes.
1	6.5 × 5 cm.	11 days	None.
2	4 × 3 cm.	9 days	None.
3	4 × 3.5 cm.	Healing rapidly 9th day	Did not return, follow-up not obtained.
4	6 × 4 cm.	Shrinking rapidly 11th day	Did not return, follow-up not obtained.
5	9 × 7 cm.	31 days	None.
7	2.5 × 2 cm.	5 days	Small crust still present
8	5 × 3 cm.	14 days	None
9	16 × 8 cm.	47 days healed, except for one small quite resistant sinus ½ cm. diameter. 70 days completely healed.	None.
10	15 × 7 cm.	52 days almost healed	Exact date could not be learned.
11	3.5 × 2.5 cm.	12 days	None.
12	5.5 × 3.5	36 days	Very deep seated.
13	8 × 6 cm.	19 days	Crust ½ cm. still present.
15	4 × 4 cm.	20 days almost healed	Did not return, follow-up not obtained.
16	9 × 5 cm.	22 days, granulating area ½ cm. diameter	Did not return.
		Cases Receiving Operative Treatment.	
6	10 × 9 cm.	62 days	Operative case.
14	9.5 × 8 cm.	77 days, healed except for small crust	Operative case.

which were treated by crucial incision. One of these, the third largest carbuncle of the series, showed 9 months after operation a crucial scar, wrinkled and depressed, 11 cm. transversely and 6.5 cm. vertically. The other, a slightly smaller carbuncle, 2½ months after operation had a depressed, wrinkled and puckered scar, 5.5 x 5 cm.

The feeling of the patients toward the treatment is distinctly favorable. This applies especially to the patients who have suffered with previous carbuncles or boils, and have comparisons to make with other forms of treatment. Case number 8 had had a number of boils prior to the carbuncle, and at follow-up he volunteered the information that he much preferred the X-ray treatment

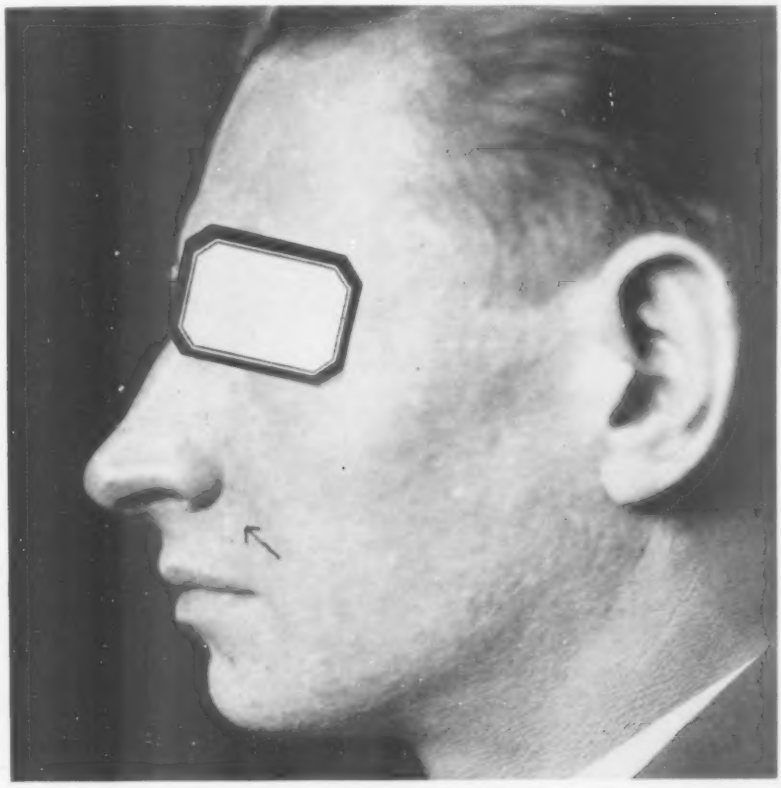

FIG. 7.—Case XI. Eight months after treatment. Showing end result on small carbuncles. Maximum size of this carbuncle was 3.5x2.5 cm.

to any other kind of treatment he had received. His scar measured ½ x ¼ cm. 5 months after treatment, and was no larger than the scars of his boils. Patient number 7 had had many small carbuncles prior to the one reported. When he returned 48 hours after X-ray, with the slough out and the wound granulated level with the skin, he volunteered the statement that in each of his previous carbuncles this period had found him suffering severely, with the carbuncle at its worst, and his physician trying application of cups to bring relief and cure. Patient number 12, a physician, who had a very deep seated process, and whose pain had been the most prolonged and severe of any of the cases, and whom I therefore regarded as my least favorable successful case, stated at his follow-up, 3 months later, that he was very

glad he had received this form of treatment, because of the comparatively small and inconspicuous scar.

This would seem a relatively safe method of treatment. No bad results were obtained, although the series contained several severe cases, and two carbuncles of the face, which are well recognized as dangerous lesions. The comparative absence of traumatism to the lesions in dealing with them by this method, as compared with operation, would seem a protective measure of importance. Martin [14] in his recent article on staphylococcus infections of the face and lips, has laid great emphasis on this factor of trauma. To quote him: "About every focus of infection a wall of leucocytes is rapidly formed. On the integrity of this wall depends whether or not the microörganisms advance into the tissues." He goes on to say that pricking, squeezing, incising, puncturing, or rough manipulations may break through the protecting wall of leucocytes and spread infection. He states: "I believe that early operations and rough manipulations in the infected area tend to spread, not limit, the infection."

SUMMARY

1. Only three reports of carbuncles treated by X-ray were found in the literature.

2. Sixteen unselected cases of carbuncles treated by X-ray are here reported.

3. Only two of these sixteen cases required operative treatment.

4. Diameters of induration increased more than 2 cm. after X-ray treatment in only two cases, and in one of these there was probably due to a too narrow protecting of the field of the X-rays in giving the treatment.

5. Sloughing and suppuration, and the skin sinuses through which this took place, were surprisingly small in the small and moderate sized carbuncles.

6. The very large carbuncles resolved into enormous, sharply demarcated abscesses, which drained satisfactorily through sinuses formed by sloughing of the overlying skin.

7. Pain was relieved following the X-ray treatment in the majority of the cases, but this did not occur invariably.

8. The duration of the small and moderate sized carbuncles seemed much shorter with X-ray therapy than under operative treatment.

9. The duration of the very large carbuncles seemed about the same with X-ray or operative treatment.

10. Cosmetic results of X-ray treatment were far superior to those of operation.

11. Great preference for the X-ray treatment was expressed by patients with experience in other forms of treatment.

12. The method seems relatively safe. The comparative absence of traumatism, as compared with operation, seems a protective measure of importance.

CONCLUSIONS

This is obviously too small a series from which to attempt to draw any sweeping conclusions. Moreover, we have in these cases no actual proof of the value of X-ray, since it did not seem justifiable to run any control cases. Nevertheless, from the evidence submitted, we would seem justified in feeling that X-ray exerts a powerful influence on the progress of carbuncle. Though in a few cases operation seems unavoidable, X-ray in the majority of cases appears to bring a speedier cure, gives a far superior cosmetic result, and has been preferred by patients familiar with both methods. The comparative absence of trauma in this method, as compared to operation, is a protective measure. We would therefore conclude that in most cases its use is to be preferred to operation.

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DIAPHRAGMATIC HERNIA

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A review of the literature on diaphragmatic hernia evidences an unusual interest to have been aroused in the subject during recent years. Early literature credits cases to Valsalva, Ambrose Paré, Sir Astley Cooper and other surgeons during intervening periods, but until the general use of the Röntgen-ray and the barium meal for the study of the stomach and intestines became a part of every routine examination, comparatively few accurate diagnoses were made. Unless they were accidentally discovered during the course of an operation for some other supposed condition, many cases remained unrecognized until autopsy. As a result hernias through the diaphragm were considered rare, but it is now apparent that many cases must have escaped the attention of the clinician.

Giffin's report of literature up to 1913, gave references to no less than 690 reported cases, but of these only fifteen had been diagnosed, the others being necropsy findings. During recent years there has been a substantial increase in the number of reported cases. It is evident that the röntgenologist and the internist in particular, have been on the alert for this condition. Then, too, the numerous types of injury received during the late war were partially responsible for these additional cases. From 1913 to 1919, Frank found forty-two additional cases, and from 1919 to 1923, ninety-six others, forty-three of which were battle casualties. Warren reported eight cases treated at the London Hospital during ten years, of which only one lived. Bevan cites four cases operated upon with three recoveries. During recent months several additional reports of cases have appeared from various sources. If time and space would permit, it would be of interest to carefully review and tabulate these numerous cases reported in literature and to make note of the variation of symptoms manifested or the necropsy findings.

Before entering in upon the discussion of the subject in general, I wish to present the following case which recently came under my observation, and which was operated upon with a complete relief of all former so annoying and obscure symptoms.

Case History.—Patient, Miss S., age twenty-three, native of Iowa, occupation, stenographer. Parents, one brother and one sister alive and well. The mother relates that ever since childhood the patient has suffered regular distress after eating. Symptoms pointing towards tuberculosis manifested themselves when she was a child two years old. The family physician advised forced feeding. As a result large quantities of bulky food consisting of several shredded wheat biscuits and milk and portions of cod-liver oil were given daily by an overzealous grandmother. After a limited period, symptoms of unusual distress followed each feeding and have continued to a greater or less degree ever since. At the age

of three, she developed a double inguinal hernia which required surgical attention in later years.

At various intervals, during intervening years, immediately after eating, she would suffer extreme distress, accompanied by a sense of suffocation, a fullness in the chest, pain referred to the heart, and as she expressed it, "a sense of smothering." She would grow pale, and attempts at belching or vomiting would often be in vain, but if successful, would be followed by a sense of relief. She acquired the usual childhood diseases. Had small-pox in 1916. Menses normal; always constipated.

Physical Examination.—The patient was markedly undernourished. Head and neck negative, except for the presence of an enlarged submaxillary gland. Her chest was of an extreme scaphoid type with a bulging of the lower costal cartilages and a tendency towards recession on the left. The abdomen was flat. No marked tenderness was elicited. A marked lateral curvature of the lower dorsal vertebra was present, but no resulting symptoms were manifested. The excursion of the right lung was retarded. Normal breath sounds were present, except over the right lower lobe, where they were faint and almost absent. The position of the heart was almost normal.

A barium meal was given and a fluoroscopic examination of the abdomen and chest was made, after which a series of röntgenograms were taken. The heart was found to be displaced slightly to the left. An abnormal shadow suggesting a definite pocket with a distinct line of demarcation was noted on the right above the diaphragm. When the test meal reached the stomach, instead of filling in the usual manner, it began to pass upwards through an opening in the diaphragm, into the chest and to completely fill the space referred to which proved to be the boundaries of a diaphragmatic hernia. About two-thirds of the stomach was above the diaphragm. A lateral view showed the opening to be in line with the œsophagus. A diagnosis of diaphragmatic hernia was made.

This was verified at operation July 27, 1922. Under ether anæsthesia, a median incision was made from the ensiform to the umbilicus. The head of the table was elevated to encourage gravitation of the abdominal viscera downwards. After obtaining a proper exposure by severing the round ligament and elevating the left lobe of the liver, an opening about three inches in diameter was demonstrated to the right of the œsophagus through which protruded a portion of the greater curvature of the stomach. The opening permitted the easy entrance of one hand into the thorax and after separating a few adhesions, the stomach was delivered into the abdomen. No attempt was made to free and deliver the sac.

The edges of the diaphragm were caught with mouse-tooth forceps, brought together and sutured with interrupted catgut stitches, three individual rows of sutures being taken. The final stitch of each row incorporated the edges of the diaphragm as well as the serosa and muscularis of the adjacent œsophagus, passing through the latter in a vertical manner. After the third row had been taken, each including the layers of the œsophagus in the final stitch, a firm wall presented itself and offered reasonable assurance that a future upward excursion of the stomach would be prevented.

She made an uneventful recovery. Later when given food, she expressed a feeling of surprise at the absence of the former chest symptoms, and as she expressed it, "that the food went down and stayed there." A gradual increase in her diet was permitted until after three months, when she was given regular meals from which she suffered no discomfort. She has remained entirely well. Her weight has increased and the chest contour has become more normal. A subsequent fluoroscopic examination indicated that a complete cure had been affected.

There seems to be a great divergence in opinion as to the real etiology of the various types of diaphragmatic hernia. Hernias of the diaphragm are either congenital or acquired. From recent reports, the latter seem to predominate, but as these include the many cases observed during recent years when unusual acts of violence resulted in tears and other injuries of the diaphragm, seldom encountered during peace times, their proportion should gradually decrease.

In these cases there is no sac present, but various parts of the entire abdominal viscera are found to have migrated or to have been forcibly displaced into the thoracic cavity. If the injury was not fatal, and remained unrecognized, the condition usually becomes permanent as there appears to be no tendency for these tears to heal, or close.

In the congenital type, different factors prevail. Embryologically, the diaphragm is constituted of a ventral portion derived from the septum transversum and a dorsal portion derived from the primitive mesentery in which is contained the developing œsophagus and stomach. The hiatus-pleuro-peritonalis is closed about the fourth week of fœtal life by a double fold of pleura and peritoneum. Muscle fibres are already present in the septum but not in the membrane closing the hiatus, which at the twelfth week appears as a transparent triangular area between the costal and spinal muscular origins.

The posterior portion of the diaphragm is the last to form. This is probably the reason why the diaphragm is often found incomplete at this point, a condition which permits the formation and development of diaphragmatic hernias. While the defect is present at birth, actual herniation may not occur until in later years. Herniation through the hiatus is perhaps the most common; especially is this true if all fœtal cases be taken into consideration.

True hernias must not be confused with an eventration of the diaphragm. In the former, there is a direct communication between the abdominal and thoracic cavities. Because of the constant intra-abdominal pressure, there is a constant tendency for the abdominal viscera to pass into the thoracic cavity, should there be any defect in the diaphragm. In this instance, a sac is usually present, though it is seldom, if ever, as definite as in the case of an inguinal or ventral hernia. A congenital absence of fibrous or muscular tissue in the dome of the diaphragm leaves only a serous membrane to form the entire partition between the thorax and abdomen. As a result, the constant intra-abdominal pressure may produce an elevation of the dome and extend to various levels of the thorax. This bulging has been termed eventration, but it is questionable if it should be classed as a hernia.

In the true type, the stomach and colon are most frequently found to be herniated. From cases reported in literature, the small bowel, pancreas, liver, spleen, and even a kidney, have been found in the hernial sac. The position of the liver directly under the right dome of the diaphragm renders the possibility of herniation less than on the left, where but slight protection

FIG. 1.—X-ray picture taken immediately following the taking of a barium meal, showing definite outline of herniated portion of stomach into thoracic cavity.

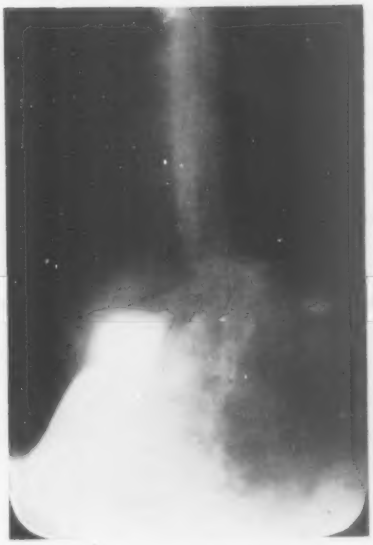

FIG. 2.—Three weeks following operation. Hernial opening closed. Sac absent.

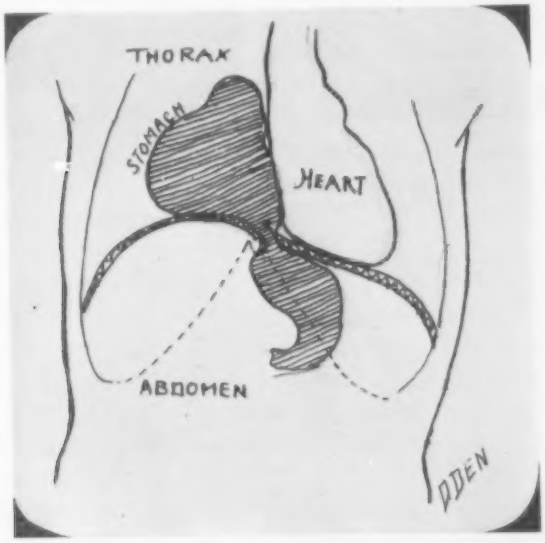

FIG. 3.—Drawing showing exact position of stomach in the thorax and the relative position of the heart.

FIG. 4.—Stomach delivered into the abdomen. One inch row of sutures in place ready to be tied. Last stitch passes vertically through the outer walls of the cardiac end of the œsophagus, to prevent a future upward excursion of the stomach.

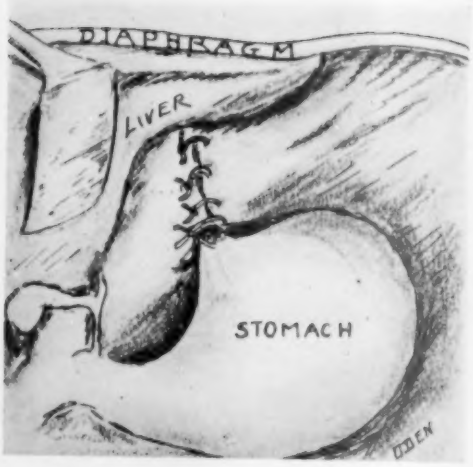

FIG. 5.—Sutures tied. Hernial opening closed.

is present. Records describe several fœtal cases where either detached lobes or the entire liver were found to be herniated, and in one instance, an autopsy of a man of forty-three, who had died from pneumonia, revealed a portion of the left lobe of the liver, together with the stomach and colon, was herniated through the left dome.

Herniation through the œsophageal opening has brought about some dispute as to the possibility of its being of congenital or acquired origin. Embryologically, as the stomach descends from its retro-pericardial position, it carries with it a portion of the peritoneum, a remnant of which may be found in the fœtus on either side of the œsophagus and forms a sort of recess. This migration is usually complete before the final development of the diaphragm. If an improper migration occurs, the stomach, instead of the œsophagus, may occupy the œsophageal opening. This is in consequence enlarged to the calibre of the stomach, though some degree of constriction is usually present.

As the œsophageal opening is normally oblique, and situated in the thick muscular portion just above the crura, it is more likely that herniation at this point is due to developmental causes rather than to a gradual or sudden rupture because of increased intra-abdominal pressure. If trauma does occur, the weakest point, which is the dome, is most likely to give way and become herniated.

There seems to be a wide divergence of opinion on this point. By making an analogy between the œsophageal opening and the external abdominal ring as normal weak points, Bevan holds that hernias of the diaphragm occurring at the œsophageal orifice are always acquired. As in a majority of these cases there is present a definite sac, this view may be tenable, but because of the embryological development as described above, there is room for a divergence of opinion. We have reasons to believe that at least not all are acquired as many of the reported cases, both in infants and adults with definite histories, give conclusive evidence that they are of congenital origin. Then, too, a large number of cases referred to in literature were reports from fœtal necropsies.

In numerous fœtal cases reported, the whole diaphragm to the left of the œsophagus and left crura were absent. Such a condition would almost seem incompatable with life. However, in one of the three cases reported by Beckman, this gross anomaly was present in a boy of seventeen.

Symptoms and Diagnosis.—Depending upon the type and cause, various symptoms present themselves. In the traumatic type, the possible associated symptoms of hemorrhage, pneumothorax, possible collapse of the lung and shock, may entirely mask the real condition. If the patient survives, irregular disturbances of the digestive tract, dyspnœa, and varied cardiac symptoms may occur without any apparent cause. In either the congenital or traumatic type, the symptoms will depend largely upon the extent and location of the opening and the portion of the viscera herniated. The symptoms are usually chronic in nature, though acute manifestations occur occasioned by functional

disturbances. There may be present symptoms, highly suggestive of gall-stone colic, pyloric obstruction, peptic ulcer and other allied lesions.

Because of the varied anatomical possibilities, it is apparent that the same pathognomonic symptoms will not always be met with, but as in the relatively great proportions of hernias the stomach or colon, or both, are found in the thoracic cavity certain symptoms are usually constant. The patient will be hungry but unable to take quantities of food, because of the pain occurring in the epigastrium directly after eating. Associated with this there follows what the patient terms a sense of smothering or dyspnœa and fullness; or pressure over the cardiac area, which in turn gives rise to great anxiety. This is increased if he is unable to vomit or belch gas, which is often rendered impossible, possibly by a spasmodic constriction of the diaphragmatic aperture. When calm and relaxed, vomiting may occur without any premonition whatever.

In view of the fact that similar observations have been noted in so many cases reported in literature, it is reasonable to ascribe epigastric pain directly after eating, inability to take quantities of food, a sense of smothering or precordial pain and distress, and inability to vomit or belch during an attack, as cardinal signs which point towards the existence of a diaphragmatic hernia.

A routine X-ray examination, including a fluoroscopic observation, is by far the surest method of making a definite diagnosis. In fact, with its use, it would seem almost impossible that a case could remain unrecognized, regardless of its history. Even though the patient presents symptoms suggesting a hernia, the definite diagnosis should rest upon the X-ray findings. If, in addition to the usual meal, a barium enema is also given, it is possible to obtain definite information as to the possible involvement of the colon.

Intestinal obstruction, strangulation and gangrene of the bowel or other involved viscera are the outstanding factors of risk to life.

Treatment.—Unless there should be some definite contra-indication after a diagnosis of diaphragmatic hernia has been made, surgical repair of the anatomical defect is the only measure to be considered. The hernia may be attacked either from above through the thorax, or from below, through a high abdominal incision. As the extent of involvement may vary to such a great degree and the types portray such a divergence of conditions, no one plan of approach would seem to be best suited to overcome all difficulties.

It is almost singular to note that in a majority of cases reported by American and British surgeons, the hernia was approached through the abdomen, while the French and Continental surgeons, including those from Scandinavia, favored the thoracic route. Fear of entering the thorax is no longer a hindrance. Since our experience in war surgery, invasion of the thorax in a liberal fashion has become more common, and it is safe to say that all hesitation will eventually disappear. The former fear of pneumothorax which was present in the minds of most surgeons has undoubtedly been a deterrent in years past. But regardless of the fact that the danger can thus be rendered to a minimum, still the abdominal route offers plausible

reasons for its use. If the table is raised so as to place the patient in a reverse Trendelenburg position, the tendency of the abdominal viscera to gravitate downwards offers definite advantages, otherwise impossible to be had. After the hernia has been reduced, it is no longer in the line of the rupture, but leaves the edges free to be sutured.

At all events, each case must be a law unto itself, and only after carefully ascertaining the extent of the involvement should any steps of attack be taken. To reduce the herniated viscera and to close the opening so as to prevent a future recurrence is the sole problem. If it is possible to overlap the edges of the diaphragm in a similar manner as used in the radical cure of an umbilical hernia, the possibility of a recurrence will be slight.

In case the hernia be at the œsophageal aperture, the closure can be accomplished to a greater degree of certainty, if as a special safeguard, the outer wall of the adjoining œsophagus be incorporated into the angle of the sutured diaphragm, as has already been described. This will remove all tendencies of a later upward migration of the adjoining viscera and materially hinder the tendency of a later recurrence of the hernia. Catgut is undoubtedly the best suture material to be used. In order to overcome and provide for a possible danger of a separation of the united edges, because of an unlooked for tension, it is good practice to use one or two linen stitches as an additional safeguard. At least it will relieve the operator of unnecessary worry.

The after-treatment is similar to that following a gastro-enterostomy. After the first twenty-four hours, liquids in small quantities may be given, at one hour intervals. The time and quantity is gradually increased as the patient progresses towards recovery. At least three months should elapse before full diet is to be permitted. Unless the patient will listen to reason and lend his coöperation, in this regard, there is a hidden danger that the resulting increased intra-abdominal pressure may become responsible for the undoing what otherwise would have resulted in absolute recovery.

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TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting Held May 7, 1923

The President, Dr. John H. Jopson, in the Chair

TORSION OF THE TESTICLE

Dr. Alexander Randall reported the history of a youth, eighteen years of age, who first when fifteen, had an attack of rather severe pain in and slight swelling of the right testicle. The pain responded in about one hour to hot applications, and the swelling disappeared. Again during the same year he had a similar attack which required a hypodermic injection. This attack was over in about one-half hour. The testicle, however, he thinks, remained slightly larger after the attack. There was no further trouble until about three months ago, when he had an attack of dull pain in the testicle, which persisted for about a half hour. It was then normal until three weeks ago when, one week following trauma, the right testicle became painful and swollen, and somewhat reddened. The pain was dragging in character and persisted for about one week. It was treated with guaiacol and other ointments with no results. The testicle became about three times normal size, and this enlargement has persisted.

The right epididymis was enlarged to three times normal size, was firm, slightly irregular, not especially tender, except with deep pressure. Skin of scrotum seems adherent to tumor in the lower outer margin and there is a slight indication of redness at that point.

March 28, 1921, the affected testicle was removed. The removal of the testicle from the scrotum was hindered by a dense band of adhesion that grasped the cord as it entered the scrotum. It was necessary to cut this and to enlarge the incision downward in order to complete the enucleation.

On incising specimen in its long axis, the epididymis was found to be the seat of a generalized hemorrhage, its normal topography being lost in an extensive blood clot. No areas of suppuration were found. The testis itself is of a dark brown color, considerably necrosed and markedly friable. It was then realized that torsion of the testicle with gangrene was the lesion present, and it was possible to demonstrate complete twist of the cord, three-fourths rotated, at the point where the above-mentioned band was cut and immediately below the point where the cord was sectioned.

VESICAL CALCULUS

Doctor Randall presented a youth nineteen years of age, who supposedly contracted gonorrhœa in the summer of 1922, coincident with which he had pain and difficulty in voiding urine which has persisted and

grown worse to the present time. The passing of a metal catheter elicited a rough grating sensation on entering the bladder. X-ray showed a peculiar shaped elongated shadow of a mass within the bladder. The bladder was opened suprapubically by Doctor Siter, February 19, 1923, and a calculus of uric acid nucleus and phosphate outer layers was removed. The calculus that was removed measures 6½ cm. in length by 1½ cm. at its greatest diameter, and grossly resembles a man's little finger in shape and size. It is definitely formed of phosphatic deposits and is of a peculiar comma-shaped curve. On the surface of the large bulbous end may be seen a surface area which is polished and suggests either foreign body or ebonization. Hemi-section of specimen shows a small round calculus lying in the bulbous end of harder character and darker color and probably of uric acid composition. It measures 2½ cm. by 1 cm. The remainder of the calculus is of soft phosphatic salts in composition. There is no evidence of any foreign body.

Evidently there has been a renal calculus passed without the usual symptoms of pain, and probably causing the discharge which had been considered gonorrhœal. It was felt that such a calculus formation could occur only by the lodging of this calculus in a diverticulum or one of the urinary passage ways with the rapid deposit of phosphatic salts about it and behind it. Certain it would be, that if it were lying free in the bladder cavity, it would form a concentric stone of oblong shape as is frequently seen.

Before the patient was discharged a cystogram was made on the 21st of March and reported as follows: "The bladder is apparently well filled with the opaque solution. There is a circumscribed bulging area on the left side and a smaller one on the right, possibly diverticula. The entire anterior urethra, the bulb and particularly the posterior urethra are markedly dilated." This plate showed the diameter of the posterior urethra to be at least 3 cm. in extent, and it is my opinion that this calculus had lodged at this location at the time of the onset of his first symptoms; it being likewise interesting to realize that its further growth had probably taken place in the course of the following six months.

BULLET IN THE BLADDER

Dr. Leon Herman reported the following case: Colored man admitted to the Pennsylvania Hospital in January, 1923. Patient had been shot some hours before, a bullet of 32-calibre entering the right hip. There was slight hæmaturia, and on examination it was noted that there was some swelling above the pubes. The X-ray examination revealed the bullet in a position apparently superficial. Doctor Mitchell explored suprapubically and found a hæmatoma to the left side of the bladder extending to the pelvic floor. Digital exploration did not locate the foreign body. The wound was drained and the patient made a prompt recovery with slight leakage of urine for the first thirty-six hours after operation. The patient was not cystoscoped prior to operation because of an acute urethritis.

Following the above procedure, a second X-ray indicated that the bullet had changed its position somewhat. Under the fluoroscope, it

was determined that the bullet could be moved by a finger placed in the rectum. Cystoscopy showed it lying on the floor of the bladder. The wound of entrance could be seen as a small, round reddened area on the right lateral wall of the bladder about one inch behind the vesical sphincter. The bullet was extracted through a suprapubic incision. Doctor Herman quoted Doctor Mullen of Idaho, as having had a patient in France, a soldier, who passed per urethram an ordinary rifle bullet, and Dr. Robert LeConte removed a stone from the bladder, the nucleus of which was found to be a grain of bird shot. The latter case was reported before this society some years ago.

VESICAL CALCULUS

Dr. Herman presented a calculus which was removed from the bladder of a young man who was admitted to the surgical service of Dr. Robert LeConte in the Pennsylvania Hospital, complaining of great dysuria and frequency of urination. On examination it was found that he had extensive genital tuberculosis. The cystoscopic examination revealed what we thought to be a small contracted bladder. It was found impossible to get a view beyond the limits of the trigonum, and the presence of ulceration and intense inflammation of the bladder, together with the presence of advanced genital tuberculosis led us to conclude that we were dealing with generalized genito-urinary tuberculosis. The X-ray, however, showed the shadow of a stone, and the various examinations for the tubercle bacillus in the urine were negative. A suprapubic incision was made and this stone was extracted from what seemed to be the posterior pouch of a bladder divided by a septum. The latter may have been a greatly enlarged interureteric bar, but at all events it served to divide the organ into two compartments. The wound healed promptly and the patient left the hospital practically without bladder symptoms.

CALCULUS IN DILATED URACHUS

Doctor Herman presented a calculus to which was attached a history as follows: An Italian, twenty-four years of age, came to the out-patient clinic of the Pennsylvania Hospital complaining of dysuria and suprapubic pain. He stated that the diagnosis of bladder stone had been made ten years before. Cystoscopy revealed an intensely inflamed bladder and a small white object projecting from the orifice of a diverticulum at the summit of the bladder. The X-ray examination showed the presence of a very large calculus at the summit of the bladder. The stone was removed suprapubically when it was found that the urachus was markedly dilated and extended to the level of the umbilicus.

Dr. Charles F. Mitchell said that the first case reported by Doctor Herman was brought to the Pennsylvania Hospital with a bullet wound in the right buttock. He showed no abdominal symptoms and no blood was passed either from the rectum or bladder. Several days later a swelling appeared in the lower abdomen over bladder region and slightly to left immediately above Poupart's ligament. X-ray picture showed bullet lying about one-half inch within the abdominal wall. An incision

was made over swelling and quite a large quantity of blood evacuated. There was no urine in the fluid and no sign or any extravasation in the tissues other than blood. The bladder wall seemed thickened and hemorrhagic. The bullet was not found and the operation terminated by simple drainage of the hæmatoma. He believed the bullet was lodged in the bladder wall at this time, and later ulcerated itself into the bladder where it was found at the second operation.

SPLENOMEGALY

DR. E. G. ALEXANDER reported a case of splenomegaly which he believed to be unusual both as to its size and for its long duration, without producing any marked constitutional symptoms.

He first saw the case on April 2 of this year in consultation with Dr. Peter P. Klopp, who had had the patient under his care since 1906.

The patient, a married woman, first consulted him in 1906 for an attack of diarrhœa, abdominal pain and vomiting. On examination he found the spleen enlarged to three or four times its natural size. The patient at that time gave a history of attacks of general itching of the skin, of dizziness, of rheumatic pains with swelling and redness of the joints, and occasionally of pains over the shafts of the tibiæ. A blood examination at that time showed a count of about 7,000,000 red blood-cells. By 1913, the spleen had doubled in size, and about this time the patient had several severe attacks of abdominal pain, nausea and vomiting and dyspnœa. In November, 1915, the patient passed blood and mucus by bowel for about five days. In 1916, the patient had several attacks of dizziness, general itching of the skin and leucorrhœa.

For the past few years has had attacks of palpitation and distress in the cardiac region. The spleen has continued to increase in size, extending at present to the pelvis. Doctor Klopp had never been able to elicit a history of venereal disease from the patient or from her husband, but in 1915, her husband had an attack of iritis which was most persistent. A thorough course of anti-syphilitic treatment had failed to produce any appreciable effect on the size of the spleen. Doctor Klopp had frequently seen the patient when she was quite cyanosed.

On April 3, 1923, the patient was admitted to the Episcopal Hospital for study; the hospital history is as follows:

M. McL., aged fifty years, female, married, white. Maternal grandfather and grandmother died of old age. Father died of a sunstroke and mother died at the age of thirty-two years during childbirth. There is no history of tuberculosis, malignancy or splenic disease in the family.

The only sickness she ever remembers having was typhoid fever at the age of sixteen years. Menses established at the age of sixteen, always irregular and scanty; menopause at the age of forty-two years. No history of any injury. Married at the age of twenty-one years, two children, both instrumental deliveries; one child died in infancy and the other died at the age of nine years of diphtheria.

When seventeen years of age she first began having pain in the left side (splenic region). Has had pain in this region off and on ever since.

Seventeen years ago noticed a " lump " in the upper left quadrant of the abdomen about the size of a baseball, and since then the " lump " has been gradually getting larger until the present time. No great pain at the time of admission, only a pulling down feeling due to weight of tumor; some tenderness at times due to pressure of the clothes. Has had attacks of abdominal pain, especially confined to this region. For the past two years she has been getting cramps in the calves of both legs, quite severe at times. Has had attacks of swelling and redness of her joints and some pain over the front of her legs. Six years ago had much itching of the skin, especially following bathing; this lasted for about two years. Does not think she has lost any weight. She has been unable to control her bowels for the last six years; is able to tell when she is going to have a movement, but cannot control them. Has indigestion and belches gas. Is quite nervous. The appetite is about normal. Has had night sweats. Never jaundiced. Has had attacks of shortness of breath and dizziness. About eight years ago had an attack of abdominal pain, which was accompanied by the passage of blood from the bowels; this condition lasted about a week.

FIG. 1.—Mrs. M. McL., aged fifty years. Case of splenomegaly. Known duration, seventeen years. Dr. E. G. Alexander's case.

Her abdomen was greatly distended, somewhat spherical in shape and had the appearance of a nine months' pregnancy; the swelling is slightly more prominent in the left half of the abdomen; no pulsations are visible. On palpation a distinct solid tumor can be felt. The mass fills the entire left abdomen and the right lower quadrant. The surface is smooth and the right margin can be easily outlined and a distinct notch is palpable about midway between the umbilicus and the xyphoid cartilage. The mass has the outline of a greatly enlarged spleen. (Fig. 1.) It is somewhat movable, and is slightly tender in certain areas on palpation. No pulsation palpable. Liver is not palpable and does not

seem to be enlarged. The patient complains of some pain over the abdomen on percussion. There is tympany in the right flank, but dullness and flatness over the remainder of the abdomen. There appears to be no ascites present.

The skin is dry, somewhat inelastic and appears to be scaly; there is no jaundice.

No œdema of the extremities; numerous brownish discolored areas over both legs. Pulse of moderate volume and tension.

The laboratory examinations were as follows: The urine was acid, light amber, specific gravity 1020, granular sediment, slight cloud of albumin, no sugar, epithelial cells, few leucocytes, 6 to 8 erythrocytes to H.P.F., urates, a few hyaline and granular casts, and bacteria present. The tests for bile and urobilin were slightly positive.

The phenolsulphonephthalein test for the first hour was 35 per cent., and the second hour 20 per cent. Urine urea 25.20 mm.

The blood showed erythrocytes, 3,950,000; leucocytes, 7,680; hæmoglobin, 68 per cent.; polymorphonuclears, 84 per cent.; mononuclears, 4 per cent.; trans., 2 per cent; lymphocytes, 9 per cent; eosinophiles, 1 per cent; one nucleated red blood-cell per 100. Considerable variation in size and shape of reds. Coagulation time 8½ minutes. Blood urea 54.00 mm. Blood sugar 99.70 mm. per 100 c.c. Blood Wassermann positive plus 2. The erythrocytes showed an increased fragility and a diminished resistance. There was no evidence of malaria.

An examination of the feces showed a small amount of mucus, no ova or parasites present.

The X-ray examination by Doctor Bromer was as follows: "Chest showed moderate hilum thickening and peribronchial infiltration in both lungs, slightly greater than normal; this could easily be the result of some old infection; there is considerable enlargement of the heart shadow to the left." "The stomach is shoved far over to the right in the liver region; it has a flattened elongated appearance." "The duodenal cap lies almost on the right border of the abdominal cavity." "On the greater curvature are indentations which are felt to be in the same position as the splenic notch, of the large mass, evidently the spleen." "The 24-hour examination shows rather rapid movement of the meal; there is a slight amount of barium still to be seen in the hepatic flexure, which seems to be in about the normal position; the sigmoid and rectum also were filled and were not displaced."

During the patient's stay in the hospital she ran practically a normal temperature, pulse and respiration rate; she was bothered, however, with looseness of the bowels.

The patient refused to consider an operation and was discharged from the hospital April 21, 1923.

Of the known diseases which are accompanied by enlargement of the spleen, it seems that malaria, Hodgkin's disease, pernicious anæmia, leukæmia, hæmolytic jaundice, Von Jaksch's disease, cysts, malignancy and trauma can all be excluded. This leaves splenic anæmia or Banti's disease, Vaquez's disease, syphilis and Gaucher's disease as possibilities.

If the condition is one of Banti's disease, it must be in the first stage, but from the history given of so long a duration and the excessive size of the spleen, the evidence seems to be against that condition.

Is this a case of polycythemia vera? The 7,000,000 red count obtained by Doctor Klopp, seventeen years ago, with a history of cyanosis, would favor that disease; we now, however, have a secondary anæmia, and this disease must be ruled out, although I am unable to say if the polycythemia in Vaquez's disease finally gives way and is supplanted by a secondary anæmia. According to Moynihan, "Polycythemia begins in adult life in males and runs a progressive and fatal course, lasting a few years."

Syphilis of the spleen, of course, is a possibility; the only evidence we have of this disease is that of a plus 2 Wassermann.

Gaucher's disease does not wholly fit the case, although it comes nearer doing so than any of the other diseases mentioned.

The fact that he was dealing with a colossal spleen (and in Gaucher's disease we meet with the largest type of splenomegaly), that the patient is a woman, that it began in all probability in childhood, that there is no jaundice or ascites, and that the general health has been very little disturbed, even though the liver is not enlarged, he was inclined to believe it to be one of Gaucher's disease.

SEPTIC EMBOLI OF MESENTERIC ARTERIOLES

Dr. E. L. Eliason detailed the history of a man, aged twenty-seven years, who was admitted to the University of Pennsylvania Hospital, with diagnosis of acute appendicitis and peritonitis; operation performed same date, found perforated gangrenous appendix, with generalized abdominal congestion and cloudy fluid. Pelvic and local drainage established. Culture showed streptococci.

The post-operative course was stormy. For nine days the patient had recurring attacks of vomiting, passed but little or no featus, was much distended and had very slight peristaltic action, and enemata were but slightly effectual. Ten days after operation a small abscess was evacuated through the original gridiron wound by digital exploration. No improvement followed. Peristalsis still markedly diminished. Patient was nourished by glucose and soda intravenously. Fifteen days from the original operation, audible and later visible peristalsis appeared and vomiting recurred. Enterostomy through left rectus incision was performed.

The patient improved greatly at once, and the enterostomy was very effective.

On the twenty-third day a left-sided parotitis developed (staphylococcus hæmolyticus) followed on the next day by a hemorrhage from the enterostomy, the blood appearing from the lumen of the proximal loop.

These hemorrhages continued for six days at intervals and resulted in death, despite blood transfusions.

Autopsy Protocol, Internal Inspection, Intestines.—The edges of the enterostomy wound are clean. In the neighborhood of the gall-bladder

there are a number of firm connective tissue bands which cause kinking of a loop of the small intestines. In the appendiceal region there is some matting together of small intestines to large intestine by recent exudate. a few drops of pus are present. The mesentery is normally fatty, and shows no gross changes. Intestines were removed and opened as usual. Enterostomy wound is present in the upper portion of the ileum. Beginning a few cm. above the wound and extending to the upper portion of the jejunum there are a number of ragged ulcerations, varying in size from several mm. to 2 cm. in diameter, situated usually at the line of mesenteric attachment, but occasionally found elsewhere and extending usually into the muscularis. About three dozen of such scattered ulcerations are found. These have not perforated, but their base is generally bloody. Dissection made to find any obstructed blood-vessels, but no evidence found that such exist. The lumen of the small intestines contains a considerable quantity of clotted blood, possibly 1500 c.c. of blood being present in the ileum. Below the enterostomy there is a superficial ulcer 15 mm. in diameter, round in shape and with clean-cut edges. This is said to be at the site of a rubber tube which had been pushed into the intestine through the surgical opening. No ulcerations such as have been described above are present. Below the enterostomy wound a large quantity of clotted blood is found, both in the small and the large intestines. The stump of the appendix and the immediate neighborhood are covered with a few drops of pus and some partially organized fibrinous exudate. The intestinal serosa otherwise is smooth, moist and glistening and nowhere coated with exudate.

Sections were prepared and examined histologically from the following parts: (1) small intestines, (2) liver, (3) spleen, (4) kidney.

Small Intestines.—Section is probably from the upper part of the ileum. At one portion there is a deep ulceration which extends well into the muscularis. The ulcer commences abruptly, its bed consists of a mass of necrotic tissue in which there are numerous plasma cells, polymorphonuclear leucocytes and occasional small round cells. Similar cellular material is present between the loosely arranged muscle fibres and between the gland tubules on either side of the ulceration. The serosa is stripped off, but there is here a moderate infiltration of similar character as the one described; the predominating cell is the plasma cell. There are no tubercles, nor areas of necrosis, such as are produced by the tubercle bacilli. The capillaries in the bed of the ulcer are moderately engorged, only small arterioles and venules are included in the section, and these possess normal walls and normal contents.

In the opinion of the pathologist the multiple ulcerations are due to embolic occlusion of small branches of the mesenteric arteries possibly by septic emboli following the infection of the appendiceal site.

REMOVAL OF FOREIGN BODY FROM THE LUNG

Dr. D. L. Despard presented a man who had been referred to Dr. Chevalier Jackson by Doctor Gibbons at the Jefferson Hospital for the relief of a wound of the thorax caused by a premature blast which had driven a piece of coal through a wound of the left chest wall in June,

1921. The wound healed except for several sinuses which persisted, and three unsuccessful operations were done in the hope of removing the cause of their persistence.

An X-ray examination revealed a foreign body within the thorax lying near the anterior axillary line. On account of the great thickness of his chest a satisfactory picture was not obtainable.

At the operation April 4, 1923, the scar tissue of the previous operation was removed together with fragments of reformed ribs. There was a great deal of hemorrhage during this part of the operation, but very little after the thorax was entered, the lung being fibrous and bleeding very little.

By following the sinuses he was finally able to detect the foreign body with a probe. Following the probe with incision enabled me to enter the cavity in which the lump of coal was imbedded, and to deliver it. The coal proved to be about an inch long by about three-quarters of an inch thick.

As the patient had expectorated shreds of cloth at times, a careful digital exploration was made to detect if possible anything else within the chest of this nature, without locating anything. The finger when turned forward came in direct contact with the pericardium at about an inch above and behind the apex.

The patient expectorated a small amount of bloody mucus, but there was no distinct communication with a bronchus. The lung cavity was packed with iodoform gauze and the patient returned to his bed.

Five days later he removed the gauze and asked Doctor Clerf to explore the cavity with a bronchoscope through the chest wall. Upon doing so a small black spot was detected hardly larger than the head of a pin, which proved to be the end of a piece of cloth about an inch long by one-quarter of an inch in diameter and apparently plugging the lumen of a bronchus, as upon its removal there was very free movement of air in and out with each expiration.

The cavity was again packed with iodoform gauze, which was changed every day or so as the case progressed, and he was inclined to believe the use of this gauze may have been a factor, by stimulating granulation, in the rapidity with which the bronchus closed and the wound healed.

The patient's general condition is satisfactory and the wound has almost healed.

A PLAN OF MANAGEMENT OF CRANIAL INJURIES*

Drs. J. S. Rodman and B. B. Neubauer said that much confusion has arisen concerning the terms concussion, contusion, and compression of the brain. When, as is so often the case, these conditions are complicated by other conditions such as intracranial hemorrhage there is still greater difficulty. It is frequently difficult, therefore, to draw a clear mental picture of the underlying pathology of these conditions and hence to decide which cases fall under these various clinical headings. It follows that without a "clear-cut" under-

* The following is offered at this time as a preliminary report on a plan now in effect at the Presbyterian Hospital, Philadelphia.

standing of the pathology and, therefore, of these clinical conditions themselves, it is impossible to lay down adequate regulations for treatment. It was with the idea of attempting to clarify this atmosphere in their own minds that led them to discard the terms of concussion, contusion and compression for practical use. The grouping of brain injuries which they suggest in their place has at least the advantage of simplicity, a much needed factor in any attempt to substitute one classification for another in regard to these injuries. In fact classifications of disease or traumatic conditions in general have no value unless on the basis of such a classification a rational treatment can be built. This essential they believe is met in the grouping they propose.

In dealing with intracranial lesions, acute or chronic, caused by disease or trauma a most important factor to take into consideration is *intracranial pressure or tension*. In most of the chronic lesions, as brain tumors, intracranial tension is given the importance due, but such is not the case in acute brain injuries. It is their belief that acute intracranial tension is just as important as chronic intracranial tension. Much has been written of acute brain injury and we do not propose to quote from this extensive literature. But while acute intracranial tension is often referred to notably by Jackson [1] and Sharp [2] it seems that to few it is the one condition which means life or death to the patient. It has come to be their belief that this is so irrespective of whether we label these cases concussion, contusion, or compression. Fortunately, intracranial tension can be estimated by clinical as well as by a more exact means, namely the spinal manometer. Furthermore, each of these groups have definite indications for treatment based entirely on the presence or absence of increased intracranial tension. On this basis they now classify all cases of brain injury as follows:

Group No. 1. No increase in intracranial tension.

Group No. 2. Moderate increase in intracranial tension.

Group No. 3. Marked increase in intracranial tension.

In order to determine which of these groups the patient falls into the following observations can now be made, after the stage of surgical shock has been passed:

A. General examination including neurological findings.

B. Observation of the temperature pulse, respiration and blood-pressure every four hours.

C. X-ray of skull.

D. Spinal puncture, being careful to estimate pressure by means of the spinal manometer. As a result of examination the following types of cases will readily fall into one of these groups. Some will, of course, pass in progressive stages from one group to another.

Into Group No. 1 (no increase in intracranial tension) those cases will fall showing abnormal spinal pressure of 8 to 10 mm. of hæmoglobin and a normal or slightly elevated blood-pressure. To these essential findings may be added the less important ones of a normal or slightly elevated temperature, pulse

and respiration, primary unconsciousness either momentary or at most lasting for several minutes, followed by headache and dizziness. Normal eye grounds. The treatment of this group is, of course, non-operative and consists of A. Rest in bed (4 to 5 days). B. Ice-cap to head. C. Sedatives as needed.

These cases of Group No. 1 always recover unless some complication arises.

In Group No. 2 (moderate increase in intracranial tension) those cases will fall showing a spinal pressure from 10 to 18 mm. of hæmoglobin moderate rise in blood-pressure, moderate rise of temperature and pulse rate, and a normal respiratory rate. These cases may show the primary unconsciousness followed by dazing and headache mentioned above. To these mental symptoms may be added mild confusion or delirium after the period of unconsciousness has passed. The eye-grounds will show a congestion of the retinal veins. The indications for treatment in this group are again non-operative and will consist of: A. Rest in bed. B. Ice-cap to head. C. Elevation of head of bed. D. Therapeutic spinal puncture (5 to 10 c.c. of spinal fluid may be removed as often as necessary usually every 24 hours for several days or as much as is needed to reduce the reading of the spinal manometer to 8 to 10 mm. of hæmoglobin.

E. Intravenous injection of hypertonic saline (60 to 80 c.c. of a 15 per cent. solution) or magnesium sulphate by mouth. Because of the ease with which magnesium sulphate may be given this is perhaps more practical than the intravenous injections of hypertonic saline although the latter solution is quicker in its effect, and in the majority of the cases of this group it is only necessary to give one injection.

The majority of the cases of this group will get well unless some complication arises.

They believe that approximately 70 per cent. of all cases with brain injury will fall into one or the other of these two groups.

Into Group No. 3 (marked increase in intracranial tension) will fall into those cases showing a spinal pressure above 18 mm. of hæmoglobin an increased blood-pressure which will fall as this stage progresses. (Pulse pressure is much more valuable than systolic or diastolic readings; when the pulse pressure equals the pulse rate a good single indication for operative relief of tension exists). These cases will show a normal or slightly elevated temperature until the final stage (medullary œdema) when hyperpyrexia is present. The pulse rate will gradually become slower as well as full and bounding until it becomes subnormal as pressure advances until medullary œdema is present and then in this closing stage will again become rapid and weak. There will be stupor increasing to coma. The eye-grounds will show congestion of the retinal veins and uncommonly paling of the optic disk. (We believe that true choked disk does not occur in an acutely increased intracranial tension), but optic atrophy may develop later.

This group they believe calls for operative relief of tension in addition to

the measures outlined in the preceding two groups. It is their practice to perform a subtemporal decompression on the right side usually with drainage and at times a bilateral subtemporal decompression.

They submit this classification of brain injuries with its indications for treatment for what it may be worth and as a preliminary report of their present views on this subject. These views are based on experience gained in the handling of such injuries largely at the Presbyterian Hospital in this city, as well as by one of them during the war. They have purposely omitted from this discussion such frequent complications of brain injuries as scalp wounds, fractures of the skull, intracranial hemorrhage, penetration of foreign bodies and localizing pressure on the brain from any cause, believing that these complications are operative indications in themselves, and that the operative management of these complications has now been well standardized in general. In closing they repeated their belief that it is intracranial tension caused by œdema which plays the important rôle in acute brain injury as it does so often in chronic brain lesions.

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TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

Stated Meeting Held May 9, 1923

The President, Dr. Eugene H. Pool, in the Chair

DIVERTICULUM OF BLADDER

Dr. Hermann Fischer presented a man, seventy-one years of age, who was admitted to hospital with complete retention of urine, from which he had been suffering for two weeks, obtaining relief during this time only by catheter. The passing of the catheter through the urethra was easy. Per rectum could be felt an indistinct soft mass just above the prostate, and pressure upon it with the tip of the finger caused a gush of thick pus to escape through the catheter. The mass had disappeared and the patient was able to urinate spontaneously.

The bladder was opened by an epicystotomy and a diverticle was found at the base of the bladder, to the left and to the front of the left ureter. The opening was round, about the size of a quarter. It was rather large as the examining finger could not reach its bottom. A circular incision was carried around the opening cutting through the wall of the bladder, care being taken not to injure the left ureter. The diverticle was then packed with a gauze tampon, its edges secured by several clamps and it was then shelled out from the perivesicular pelvic tissue by a blunt dissection without great difficulty. The large extravesicular cavity left after the removal of the diverticulum was tamponed, the tampon being led out along the lateral wall of the bladder. The wound of the bladder was entirely closed by two rows of sutures and the bladder drained by tube through the epicystotomy wound. The tampon was removed on the fourth day after operation. The patient made a good recovery and was out of bed after two weeks. There was, however, some delay in the healing of the suprapubic wound which would alternately open and close for several months. He passed urine in a normal stream and without difficulty and pain. The patient would have considered himself well had it not been for the little leakage off and on from the suprapubic wound. He was readmitted three months after the operation. Cystoscopy showed a moderate cystitis with a slight prostatic hypertrophy. At the seat of the former mouth of the diverticulum there is a smooth white linear scar of the mucous membrane. Insertion of an indwelling catheter. This was well borne by the patient, and after two weeks the suprapubic wound had closed and the patient could be discharged cured.

There was never any leakage of urine along the tampon, as the bladder wound healed by primary union. This diverticulum was

so-called spurious or false diverticulum, its walls consisting of only mucous membrane, no muscular fibres being present. Several years ago he observed a case of an old man with prostatic hypertrophy, who also had a huge congenital diverticulum, which was larger than the bladder, and which was situated at its vertex. In this case only drainage was employed.

DR. CHARLES L. GIBSON said that in a similar case he had used a mild procedure tentatively with satisfactory results. All he did was to burn away the diaphragmatic opening and, although the patient has a slight cystitis, he has gotten along as well as if a more radical operation had been done.

ACUTE PERFORATION OF THE STOMACH

DR. CHARLES L. GIBSON presented a man, aged twenty-eight years, who was admitted to the New York Hospital, March 29, 1923, with the history that he had had some mild gastric manifestations about two weeks before present illness. One hour ago patient developed sudden sharp pain in the right upper abdomen which caused him to collapse. Shortly afterwards marked pain appeared in the region of the lower cervical spine; but did not persist.

Examination showed patient moderately developed and nourished, in great pain and moderate shock. There was no obliteration of the liver dulness. Board-like rigidity and great tenderness of whole upper abdomen.

Fluoroscopic examination and X-ray plate showed a distinct layer of air under the diaphragm on the right side, possibly also less clearly on the left side.

Immediate operation was done after prior ingestion of methylene blue. Peritoneum opened under water. Much gas and presence of methylene blue in the abundant ropy fluid. Perforation three-eighths of an inch in diameter on gastric side of pylorus. Patient made a good recovery with a slight superficial infection of the wound. Discharged April 12, 1923.

DOCTOR GIBSON said that he presented this case because it presents all the possible diagnostic points: 1. Previous gastric history. 2. Sudden onset with collapse and typical abdominal findings. 3. Secondary or referred pain—a very characteristic, diagnostic feature generally in the supraclavicular fossa, usually the left. This secondary pain comes shortly after the original pain and usually does not last very long. It is apt to be forgotten by the patient and is not usually mentioned in books. 4. The presence of air, free in the abdominal cavity as demonstrated by fluoroscopy and X-ray picture. 5. The absence of the sign designated as "obliteration of liver dulness." Never seen by him in any perforation of gastro-intestinal tract. 6. The presence of air free in the abdominal cavity when the peritoneum is opened between two clamps, wound being flooded with water. The exit of air under these conditions is absolute proof of a perforation of the gastro-intestinal tract. On the other hand, a perforation may exist without this sign being present. 7. The presence of methylene blue in the abdominal contents.

ACUTE PERFORATION OF STOMACH WITH TRANSPOSITION OF VISCERA

DOCTOR GIBSON presented a man, aged forty-one years, who was admitted to the New York Hospital April 16, 1923.

For two or three days he suffered an exacerbation of long standing gastric disturbance. Two hours before admission sudden, very severe, cramp-like pain in epigastrium. Brought to hospital in ambulance.

He was a large, well developed man, in great pain and moderate shock. The abdomen is retracted, board-like, and the maximum of pain

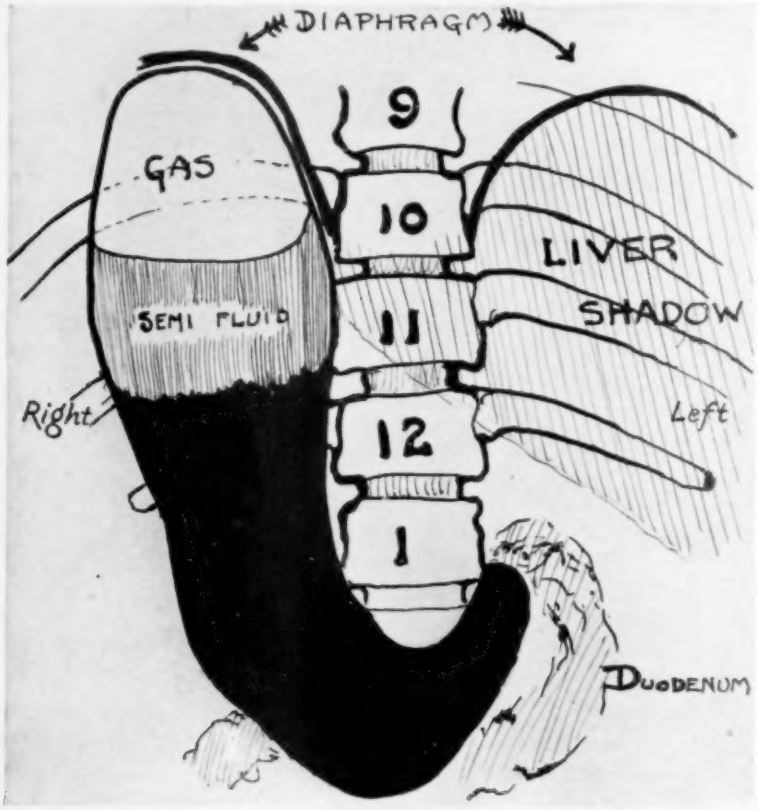

FIG. 1.—Transposition of viscera and perforated ulcer. (Diagram kindly furnished by Dr. Clay Ray Murray, Deputy Assistant Surgeon, New York Hospital.)

tenderness and rigidity are just above the umbilicus. There is no obliteration of the liver dulness.

Fluoroscopy to detect air under the diaphragm shows that the patient has a transposition of viscera (Fig. 1), so the operation is planned to expose the pylorus by an incision to the outer border of the *left* rectus muscle.

Immediate operation after administration of methylene blue. Peritoneum opened under water. No gas. Opening in peritoneum is sealed by adherent omentum. Mucilaginous, bluish colored fluid is seen coming from under left costal arch. Perforation is found on upper

surface, just para-pyloric. It is three-quarters of an inch in diameter, indurated base size of twenty-five cent piece. Easily closed with double chromic gut sutures.

Uneventful recovery, discharged sixteen days after operation.

NOTE: It is possible that this is the first instance of a pre-operative diagnosis of this condition. Summers, Nebraska State Medical Journal, April, 1923, says: "In abdominal surgery I do not know of an instance which has been recorded in which a transposition of the abdominal viscera had been diagnosed before the abdomen was opened."

DR. JOHN DOUGLAS said as to reference of the pain to the upper clavicular region in these cases of acute perforation of the stomach, he had never had any of his own patients complain of such pain, but had never questioned them thereon. As to the loss of liver dulness, he thought this depended on the amount of gas escaping from the perforation, and he did not see why, if the patient is propped up, some of that gas should not rise to the upper part of the abdomen, and if the falciform ligament were sufficiently lax, obliterate the liver dulness. Although this symptom is not present in all cases, he felt very sure that it had been present in several of his cases of perforation. As to gas under the dome of the diaphragm, he had never had an opportunity to see that by fluoroscopic examination, but within the last six or eight months he had one case of perforation which occurred within four hours of the time of taking bismuth for an X-ray picture. There was no evidence from the X-ray from which a diagnosis of perforation could be made; there was no air under the diaphragm although some of the bismuth had leaked out of the perforation of the duodenum and a portion of it had gravitated down along the under surface of the left lobe of the liver.

PARTIAL COLECTOMY FOR MEGACOLON

DR. R. W. BOLLING presented a boy, now fourteen years of age, who first came under observation two years ago when he was admitted to the Medical Service at St. Luke's Hospital. There was a history of constipation since birth, abdominal distention and, in recent years, frequent attacks of intermittent abdominal pain.

The immediate cause of admission was severe abdominal pain and distention unrelieved by cathartics or enemata. He was found to have a large fecal impaction, which was removed, and under medical treatment his symptoms were relieved and he was discharged eighteen days after admission.

At this time a bismuth injection showed a greatly dilated and redundant sigmoid colon and rectum. He remained well for about one month, when the symptoms recurred, again yielding to medical treatment carried out at home. From this time until one year ago he suffered at intervals. One year ago he was readmitted to the medical service at St. Luke's in a condition similar to that on his previous admission, and he was eventually referred to Surgical Division A and assigned to Doctor Bolling for treatment.

At this time a bismuth injection confirmed the previous findings with possibly a greater dilatation of the sigmoid colon (Fig. 2). In July, 1922, he was operated on. Two feet of the large intestine, including the

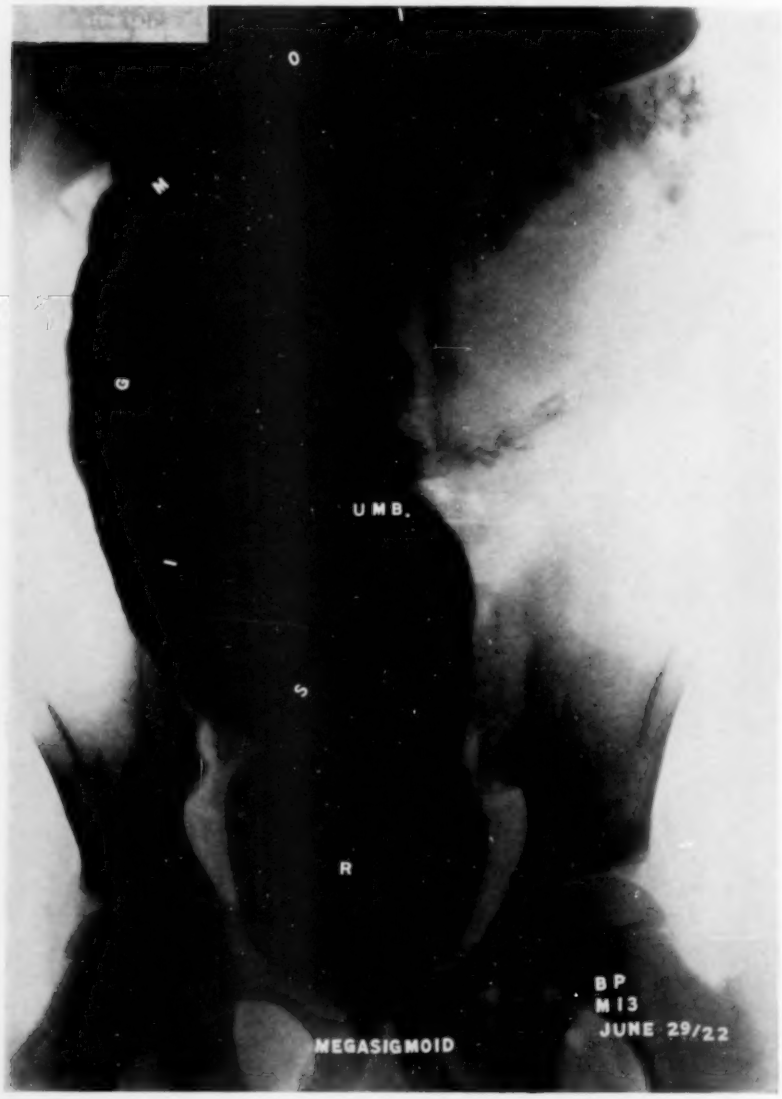

FIG. 2.—Megacolon. Bismuth injection before operation.

sigmoid, were resected, the descending colon being united to the recto-sigmoid by means of a lateral anastomosis. At operation the sigmoid colon and rectum were found to be greatly dilated and the walls thickened. The remainder of the intestine appeared somewhat dilated but relatively normal. After completing the anastomosis a tube was carried from the anus through the stoma into the splenic flexure.

The post-operative course was uneventful and the wound healed by primary union, the small rubber dam drain being carried out through a stab wound. The boy was discharged from the hospital nineteen days

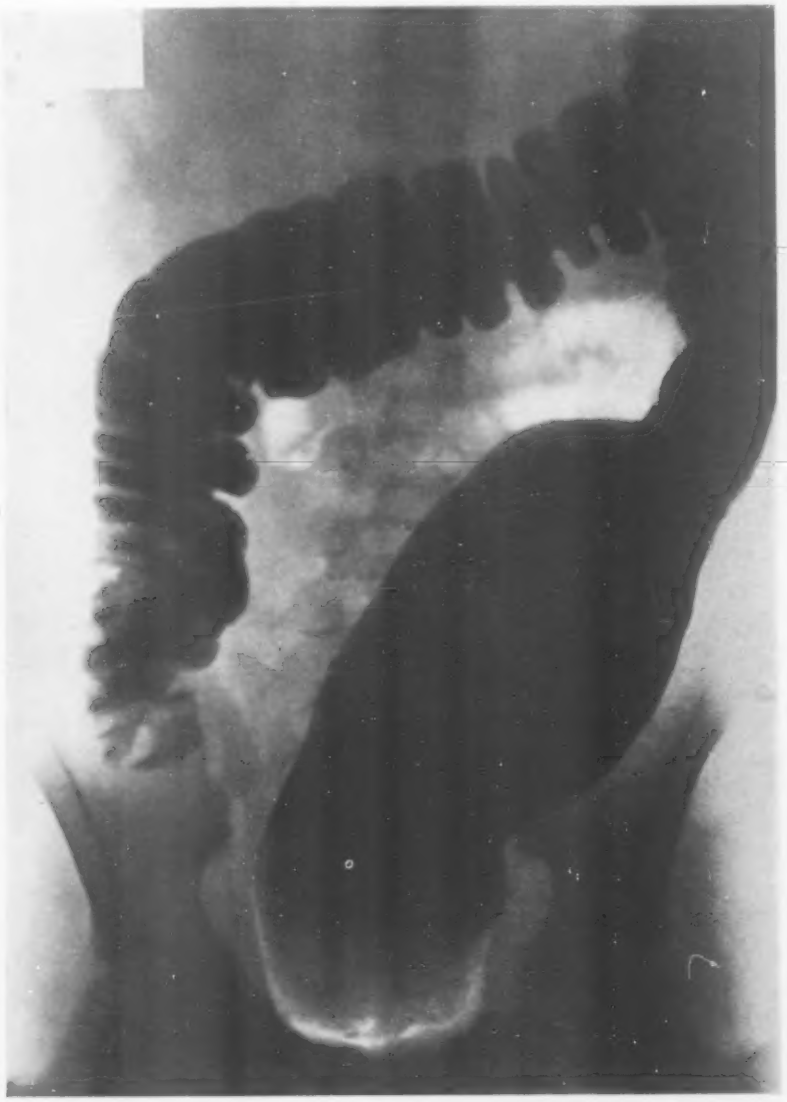

FIG. 3.—Partial colectomy for megacolon. Bismuth injection eight months after operation. The bismuth was completely eliminated in twenty minutes.

after operation. Since discharge he has had no symptoms, has not missed a day at school and has gained 22 pounds in weight. His bowels are usually regular, but sometimes he goes three days without a movement, apparently from lack of inclination to evacuate his bowels. A bismuth injection (Fig. 3) was completely eliminated in twenty minutes.

It is difficult to say whether such a condition is congenital or acquired.

Possibly there is a congenital defect in the innervation of the lower bowel tending to fecal impaction which resulted in dilatation and hypertrophy of the large intestine above. Certainly such patients afford quite a problem, and operation is not to be undertaken lightly. The home conditions of this patient were investigated and operation decided on only when it was evident that the usual palliative measures to prevent future attacks could not be regularly carried out. The operation performed was in a sense only palliative as an abnormal rectum remains, and the development of this boy will be followed with great interest.

Dr. Leon T. LeWald said that the problem that presented itself in the cases of megacolon was the functioning of the colon. Although in this case a large segment of the colon has been resected and there is still some dilatation, the function is perfectly good, while prior to operation it was decidedly pathological.

Röntgen examination not only makes or confirms the diagnosis in this condition, but by means of a very careful study will frequently reveal the fact that the dilatation does not involve the entire colon. It may, for example, involve only the descending colon and sigmoid flexure. In other cases the dilatation may involve separate portions of the colon, such as the hepatic flexure, splenic or sigmoid flexure, or all three of these regions. Or there may be a combination of dilatation of the lower portion of the large bowel associated with marked redundancy of the sigmoid flexure. At the time Hirschsprung described the condition which is known by his name he had no opportunity to examine radiographically the different types of dilated colon. Inasmuch as there are hardly two cases alike it becomes all the more necessary to examine a particular case radiographically with extreme care, both by means of an opaque meal and an opaque injection.

ACUTE INTUSSUSCEPTION IN INFANTS

Dr. Richard W. Bolling read a paper with the above title, for which see Annals of Surgery, vol. lxxviii, p. 349, 1923.

Dr. Charles E. Farr said that of about thirty cases of intussusception which had been under his care two were adults, one with carcinoma and the other sarcoma of the bowel, and several were older children. He agreed with almost everything Doctor Bolling said, and particularly with the statement that these infants look to be in good condition. They are not shocked for perhaps twenty-four hours, but they do not stand operation very well after two or three days. As to the nomenclature, he would designate the condition as enteric or colonic intussusception. As to the use of the X-ray, he had found this extremely valuable and has found an intussusception under the fluoroscope. There are other conditions that give blood in the stool and make the differential diagnosis difficult, but these children are not obstructed in any way. He had one case of appendicitis with intestinal symptoms that would make one think of intussusception. As to treatment, operation is the only thing, and the hydrostatic method in combination is of some help.

Dr. Robert T. Morris, speaking of the etiology, said that intussusception is probably an expression of several causes, and one of these may be an elective affinity of the region for certain toxins, resulting in spasm of the circular fibres. The spastic area is then engulfed by peristaltic progression. The experiment may be made by touching a rabbit's bowel with a trifle of carbonate of sodium. He believed that in the cases where there was gangrene and the patient is in desperate condition one should not do good surgery; split the intussusception open quickly, take a suture on either side to the abdominal wall, and let the child live. Later, complete the operation. He has had an intussusception recur while looking at it, but taking a stitch through the bowel wall above and below the involved area and hitching these points to the abdominal wall solved the problem.

Dr. Edward W. Peterson had reported about a year ago forty-six cases of intussusception in infants and children and has had two cases since then. He has not resorted to the X-ray for diagnosis in any of his cases, although he believes it to be a valuable measure. He quoted from his report as to the etiology of the disease and also as to results, in his series of cases. In two cases, in boys four and one-half and seven years, respectively, a Meckel's diverticulum was the causative factor in the production of the intussusception. In another case, a six and one-half months' old male infant, a congenital tumor of the cæcum (cystadenoma) was the cause. In another infant, the last two inches of ileum, not involved in an ileocæcal intussusception, appeared macroscopically to be the seat of a papillary angiomatous growth. The pathologist, however, pronounced the growth to be merely inflammatory. Appendicitis is believed to have been the causative factor in several instances. It has been his rule to make the removal of the appendix a step in the operation, believing that occasionally appendicular irritation induced the spasm and brought about the invagination. Since the histological study of these appendices has been taken up as a routine measure, it has been found that a certain number of them show definite, acute inflammation, even where no trauma to this organ was present. Enlarged mesenteric glands were found in a considerable proportion of these cases, but were thought to be the result rather than the cause of the trouble. In the majority of the cases, no unmistakable causative factor was found to account for the intussusception.

As to results, one infant who had been ill for seven days with intussusception was moribund when brought to the hospital and died within an hour of admission. Another late case, ill for three days, died on the operating table just as the operation was started. A gangrenous, irreducible, double intussusception was removed post-mortem. There was but one successful reduction without resort to laparotomy. The patient, a girl five years of age, was seen in consultation with Dr. A. H. Cilley and presented the usual history and symptoms of intussusception. Following hydrostatic pressure and postural treatment, relief was obtained. Of the remaining 45 cases, 30 were reducible and 15 were either gangrenous or irreducible or both. In the first group there

were 3 deaths, due to an overwhelming toxæmia, 9 hours, 7 hours, and 5 hours after reduction in infants who had been ill 4 days, 3 days, and 3 days respectively. Another fatality occurred in a boy who developed a colic intussusception while ill with influenza, during the 1918 epidemic. Reduction was accomplished with ease about 6 hours after the onset, but death followed 4 days later and was due to a double influenza pneumonia. Another case developed pneumonia after leaving the hospital and died of this disease on the fourteenth day following operation. Another late death occurred in a four-months-old infant 21 days following operation, after dismissal from the hospital. In this instance the cause of death was not determined. To sum up the results in the reduction cases: There were 24 cures and 6 deaths, mortality 20 per cent. If allowed to exclude the deaths not directly due to the intestinal obstruction or to the surgical treatment thereof, the mortality would drop to 10 per cent. There were several recoveries in late and profoundly toxic cases. The longest interval between the onset of the disease and a successful reduction was 4 days; the shortest was 5 hours. Every case in this group seen within 48 hours of the onset recovered, with the single exception of the boy who died of influenza pneumonia. In the second group of 15 cases requiring resection there were 4 recoveries and 11 deaths; mortality 72.4 per cent. Of the thousands of cases of intussusception which have been reported throughout the world, there are on record less than a score of successful resections in infants. In older children the statistics are not quite so appalling. In 1905, the speaker had presented before the Surgical Section of the Academy of Medicine the first successful resection of a gangrenous intussusception in an infant on record. Since that time he has had two other successful resections, one in an infant eight months old and the third in a boy four and one-half years old. The fourth successful operation in this series was performed by Doctor Silleck. Of the 11 fatal cases, 9 were in infants.

Dr. Winfield Scott Schley referred to Doctor Peterson's case of recovery after gangrenous intussusception as being the first on record. His own case, shown before the Section on Surgery of the Academy of Medicine a year or so later and published in St. Luke's Annual Report for 1910, was the second case on record. Doctor Peterson's case recovered after being operated on four days after the onset of the symptoms. Doctor Schley's patient, a girl six years of age, recovered after being operated on six days after the onset of the symptoms. These cases were both rare, and interesting in that they recovered after so severe a pathology.

Dr. Theodore Dunham spoke of a child he had operated on where the intussusception was in the small intestine. Manual reduction was difficult, but successful. Just as the final disengagement of the intussusception was accomplished, the patient ceased breathing, the pupils fully dilated and, for a short time, the situation was alarming. Under restorative measures the child began to breathe and complete recovery was uneventful. Doctor Dunham said he spoke of the case as an instance of the shock which might be involved in reduction.

Dr. Charles Gordon Heyd said that he had made it a rule to remove the appendix and had never seen any bad results following this procedure. The clinical condition was absolutely clear cut and distinct, and it is an interesting fact that the internes at the hospital uniformly make the diagnosis but that the practitioners on the outside delay in making the diagnosis and the patients reach the hospital in an extremely desperate condition. Doctor Heyd was in accord with Doctor Bolling as to the necessity of very careful suturing of the abdominal wall, as he had two recent cases where a hernia had developed in the incision. It has been Doctor Heyd's experience that the intussusception reduces itself easily or it does not, and one should make two or three attempts at reduction and then make the decision to resect rather than to continuously attempt reduction, for it was his experience that if reduction did not occur readily it was doubtful if it would be brought about by persistent manipulation. As to mortality, the most frequent cause of Doctor Heyd's mortality was not the surgery but the pneumonia and the ileal colitis that developed as complications many days after the laparotomy. He did not consider there was any place for aero-hydrostatic procedures in the reduction of an intussusception but that it demanded a laparotomy the moment the diagnosis was made.

Doctor Bolling in closing the discussion said in reference to removal of the appendix, that early in his experience with intussusception his attention was directed to two cases where appendectomy was carried out in the course of operation for the reduction of early intussusception. Both of these infants died from peritonitis, and the autopsy revealed leakage from the appendix stump. Naturally this prejudiced him against routine appendectomy, and as he has operated on more and more of these cases, he has been impressed with the fact that it is an unnecessary detail.

An obviously gangrenous appendix or an inverted appendix should of course be removed. If the appendix is at all involved in the intussusception it would naturally show inflammatory changes, which he did not think could point to the appendix being the cause of the intussusception.

BOOK REVIEWS

DISEASES OF THE RECTUM, ANUS AND COLON. By SAMUEL G. GANT, M.D., LL.D. Three volumes. Philadelphia. W. B. Saunders Co., 1923.

The author has attempted to present a treatise upon the entire subject of diseases of the rectum, colon and anus covering the history, etiology, pathology, symptoms, diagnosis, treatment and post-operative management of pathologic conditions affecting this portion of the alimentary tract. For convenience the work has been separated into three volumes. The first two dealing with the rectum and anus and the third with the colon and ileocolic angle.

All of the subject matter is attractively arranged and profusely illustrated as evidenced by the 1128 cuts and many colored inserts, the great majority illustrating the author's personal procedures, and showing the mechanical ingenuity of the writer and his ability to devise instruments and appliances to meet the various needs of an operator on these conditions.

This tends to lend a monographic representation to the work as a whole, and it is noted especially that little if any credit is given other innovators where their methods are mentioned, and further that slight or insignificant modifications of classical operations are given a caption of "author's technic." This continued, unnecessary and repeated reiteration, the reviewer feels tends to detract from the general excellent exposition of the subjects (refer to vol. xi, Figs. 637-639-642 *ad infinitum*, are methods universally employed and illustrate the objection raised).

Dogmatic statement of superior results obtained by the author's methods and belittlement of contemporary surgeons' efforts by other means which are more generally recognized is a further criticism. One illustration of which will suffice, ref. vol. xi, pp. 53–54, Figs. 405–406, *"Author's excision."* This operation was done many years before the author practised medicine and has either now been superseded by that of Moschcowitz (three lines on page 56 being accorded this important reference), or is utilized in conjunction with it.

The author's confusion of terminology is also noted, ref. vol. i, Chapter XVI, p. 260, here the terms "proctitis" and "rectitis" are used interchangeably, in fact the first paragraph begins with "Proctitis" and the second with "Rectitis." These observations are of course unessential, but do not lend themselves to the generally excellent presentation of the subject which represents observations and results based on a large experience such as may be acquired in a metropolitan hospital.

The work will undoubtedly prove of great value to the reader not experienced in the latest procedures in these intricate problems. Certainly it represents the most ambitious and complete consideration of diseases of the lower intestinal tract as yet published in the United States.

JAMES T. PILCHER.

DISEASES OF THE EAR, NOSE AND THROAT, MEDICAL AND SURGICAL. By WENDELL CHRISTOPHER PHILLIPS, M.D., Professor of Otology, New York Post-Graduate Medical School and Hospital. Sixth Revised Edition. Philadelphia, F. A. Davis Company, Publishers, 1922.

Thirty-four more pages and thirty-three more engravings are contained in the present (sixth) edition than were found in the first, printed eleven years ago. Thus Doctor Phillips and his publishers are making good in their intention to keep this work up to the minute and to incorporate all that is really gain and progress in the science of otology, rhinology and laryngology.

The previous and more extensive reviews of this excellent and standard work which have previously appeared here and in the pages of other current periodicals make it unnecessary to again rehearse its merits, other than to give an abbreviated summary of contents, as follows: The specialist's office equipment, methods of examination of patients, physiology of the hearing apparatus, and the general etiology, symptomology, diagnosis and therapy of ear diseases; the surgical anatomy, diseases, malformations, anomalies and neoplasms of the external ear; diseases and injuries of the drum membrane, the anatomy, classification and diseases of the middle ear, the simple and radical mastoid operations, purulent labyrinthitis, lateral sinus thrombosis, meningitis and otitis brain abscess; otosclerosis and diseases of the auditory nerve, the influence and effects of tuberculosis, lupus, syphilis, diphtheria, scarlatina, measles, typhoid and typhus upon the ear, nose and throat; inflammations and injuries of the nasal mucosa, the nasal accessory sinuses, the nasal septum, and also the details of their correction, and the occurrence of epistaxis, foreign bodies, neuroses and neoplasms; the special fields of the pharynx, fauces and larynx are likewise covered with equal attention, and a complete description of the modern method of removal of the larynx and of suspension laryngoscopy are here given in addition to the matter found in previous editions.

WILLIAM C. BRAISLIN.

CORRESPONDENCE

GASTRO-COLIC FISTULA

EDITOR, ANNALS OF SURGERY:

Sir:

In the April number of the last volume of ANNALS OF SURGERY (vol. lxxvii), Dr. George P. Pratt contributed an interesting review of cases of gastro-colic fistula, with a report of a case operated on by him. As this condition occurs often enough to be of diagnostic and surgical interest, but as the number of cases in the literature is still extremely limited, I am prompted to submit to you the following case report:

Mrs. E. F. K., housewife, age forty-six, married twenty-four years. The family history was negative. She had the usual diseases of childhood, as well as yellow fever, and bronchial pneumonia at thirty-two. Her menstrual history was without incident, the menopause occurring abruptly in January, 1919, in the course of the illness described below. She had had four full term, normal deliveries, and one miscarriage. She had been constipated all her life but her digestion was excellent. Her average weight was 112, and her general health always good, though she had never considered herself robust.

Her present illness began seven years before operation, with continuous dull pain in the epigastrium, radiating to the back, and occasional acute pains, most marked in the back. There were gaseous eructations and general digestive discomfort, with increased constipation, but no acute illness and no nausea or vomiting. The kind of food she ate did not influence the condition. In the spring of 1918, she suddenly lost her appetite and for nearly a year ate practically nothing. Six months later she began to vomit undigested food at intervals, and she noticed that her breath was extremely foul. Ordinary remedies were tried without avail, and by January, 1919, her condition had become grave. She was forced to remain in bed and there was practically continuous vomiting, the food returning undigested from several hours to two or three days after ingestion. She had a constant sense of fullness in the epigastrium, a feeling of "being packed," as she described it. At intervals she vomited liquid brown material of very foul odor, and for six weeks in the spring of this year she had greenish-black stools, also of very foul odor. Shortly afterwards her appetite became enormous and she ate quantities of solid food at frequent intervals, followed by intense vomiting spells as described above. As there had been no relief from the various measures tried she became discouraged and for three months tried Christian Science and homœopathy, of course without results. During this period she had two attacks of excruciating pain in the right lower abdomen; she had also a constant sensation of numbness in her hands and feet, and she lost her sense of touch entirely. Her weight had dropped to 78 pounds. Her teeth had been investigated and several extracted with no benefit.

When I first saw her early in October she was extremely emaciated and complained constantly of epigastric pain. There was some contraction of the muscles of both legs and of the extensor muscles of the hands. A palpable mass could be outlined in the upper right quadrant, corresponding with the location of the pylorus. The X-ray examination showed some pyloric obstruction, with

a marked gastric retention at six hours, and we thought the condition unquestionably malignant. Careful treatment for three weeks improved her general condition considerably, and made an exploratory operation a reasonably safe procedure.

Laparotomy was accordingly done under ether anæsthesia, October 27. The cæcum and ascending colon were enormously dilated and the walls greatly thickened owing to a partial obstruction at one point in the transverse colon where it was attached to a mass apparently springing from the pylorus. This mass was fully three inches in diameter and was densely adherent to the liver and surrounding structures. After the colon had been separated from the pyloric mass an opening was revealed between the stomach and the bowel, evidently of long duration. The intestine was sutured by the usual technic, and the pylorus, together with three inches of the stomach, was resected according to the Billroth technic, and a posterior no loop gastro-enterostomy was performed. The stomach and duodenal ends were closed with no attempt at anastomosis.

The patient stood the operation well, and although she was critically ill for several days she finally began to improve, and was discharged from the hospital on the twenty-seventh day. She had been nourishing well and was gaining in strength, although she was still extremely weak. She remained in bed until the end of December, then gradually began to resume her usual mode of life, and at the end of six months was practically normal. Since the operation she has had no digestive symptoms of any sort, her diet is unrestricted, and she weighs 111 pounds. She is very active and regards herself as perfectly well.

The pathologist reported the specimen a perforated pyloric ulcer.

C. Jeff Miller, M.D.,
New Orleans, La.

A GRIDIRON AND A HALF-GRIDIRON INCISION IN OPERATIONS ON THE BILIARY TRACT

Editor Annals of Surgery:

Sir:

There is a group of cases requiring exploration of the biliary tract in which the abdominal wall is relaxed and the transversalis muscle is thinned and weakened. The usual approach by a high incision, separating the fibres of the right rectus, cuts the transversalis across its fibres. A transverse incision, more or less parallel to the ribs, cuts the rectus fibres and splits the transversalis. I have found it useful in somewhat relaxed abdominal walls to split both the fibres of the rectus and the transversalis making a gridiron incision.

The patient is placed on an operating table so constructed as to break in the middle. A sand bag is set directly over the break in the table and the patient so placed that the ensiform cartilage is also directly over the break.

An S-curved incision is begun at the very tip of the ensiform cartilage and is carried liberally downward to a point two inches above and two inches to the right of the umbilicus. The sheath of the rectus and the muscle itself are split longitudinally at the junction of its inner and middle third and well retracted, exposing the fibres of the transversalis fascia and the muscle beneath running inward and somewhat upward to the mid-line. At a point two fingers' breadth below the tenth costal cartilage the muscle fibres are split transversely and the peritoneum opened. This split running with the fibres of the trans-

versalis, slightly upward and inward, is lengthened under the inner and outer portions of the retracted rectus and the liver edge exposed.

In several instances the gall-bladder has promptly popped into the opening and in others it has been readily reached.

The incision is adequate for drainage of the gall-bladder, and in less muscular cases cholecystectomy and choledochtomy are accomplished without difficulty.

No attempt is to be made to pack above the liver nor to rotate it downward from the diaphragm. On the contrary, the incision made sufficiently high will allow traction upward on the round ligament with rotation backward and upward of the liver, and if it proves inadequate it is easy to convert it into a half-gridiron by making a vertical incision upward or downward from its inner end under the rectus.

Its advantages are a comparative freedom from danger of hernia and its applicability that it is feasible in the conditions in which a hernia is most to be dreaded—in the drainage of a gall-bladder the seat of gangrene or advanced suppuration or in working through a flabby or poorly nourished wall. Under these conditions it has proven a valuable procedure in the author's hands in his work at the Brooklyn Hospital.

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